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INTERIM TECHNICAL REPORT

Submitted to

AFAL/AAA
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1. INTRODUCTION

This interim report describes the work performed from 27 March to 30 September 1978 on Phase I of Contract F33615-78-C-1517, Multifunction-Multiband Airborne Radio System (MFBARS) Study. The objective of Phase I of the study is to define a wide range of alternative Communication, Navigation and Identification (CNI) architectures, to develop an approach for economic comparison of architectures, to establish criteria for selecting among the alternatives based on a set of requirements furnished by the government and to recommend a specific approach or approaches to be detailed further in the second phase of the study. Section 2 of this report describes the architectures that have been developed. Section 3 discusses the criteria for selecting among the alternative architectures and contains our recommended approaches to be analyzed further during the next phase of the MFBARS Study. It was supported by detailed economic analysis which is discussed in Section 4.

The first step in performing the study consisted of reviewing and analyzing the results of previous studies related to CNI integration. This analysis in combination with information and direction from AFAL resulted in an assessment degree of time-sharing and pulse interleaving possible for the MFBARS resources such as antennas, transmitter power amplifier, IF amplifiers and signal processor channels. It also resulted in the establishment of a set of guidelines and ground rules that were used in the performance of the rest of the study tasks.

Next several different overall architectures were developed. One of these architectures was a totally non-integrated configuration consisting of a set of separate equipment units, one for each CNI function (HF, VHF AM, VHF FM, UHF, JTIDS, IFF, TACAN, GPS, etc.). The units were assumed to be a next generation development beyond the current developed version of the equivalent unit. A second architecture that was defined was partially integrated by combining the JTIDS, IFF and TACAN functions into a single equipment unit. A third non-integrated architecture uses common modules across the discrete LRUs. The remaining architectures are totally integrated configurations providing an equivalent CNI capability to that of the totally non-integrated baseline. All architectures that were selected for economic analysis contain four major subsystems: the antenna subsystem, the RF/IF subsystem, the signal distribution subsystem and the signal processing subsystem, see Figure 1-1. We considered integrating the wideband and narrowband signal processors with the IF modules. One of the selected architectures, No. 5, has the wideband signal processor integrated with the associated IF resources. We determined that it would not be cost-effective to integrate a narrowband signal processor with each IF strip. The increased number of processors required would more than offset the savings resulting from eliminating the corresponding on-bus and off-bus couplers. One contributing factor to the comparatively low cost of distributing the narrowband signals results from combining the signals through time division multiplexing (TDM) before transmitting the information over the bus. For the architectures that use an FDM signal distribution bus the cost is further minimized by employing the standard 70 MHz carrier frequency of the IF modules as the common FDM frequency for the narrowband signals.

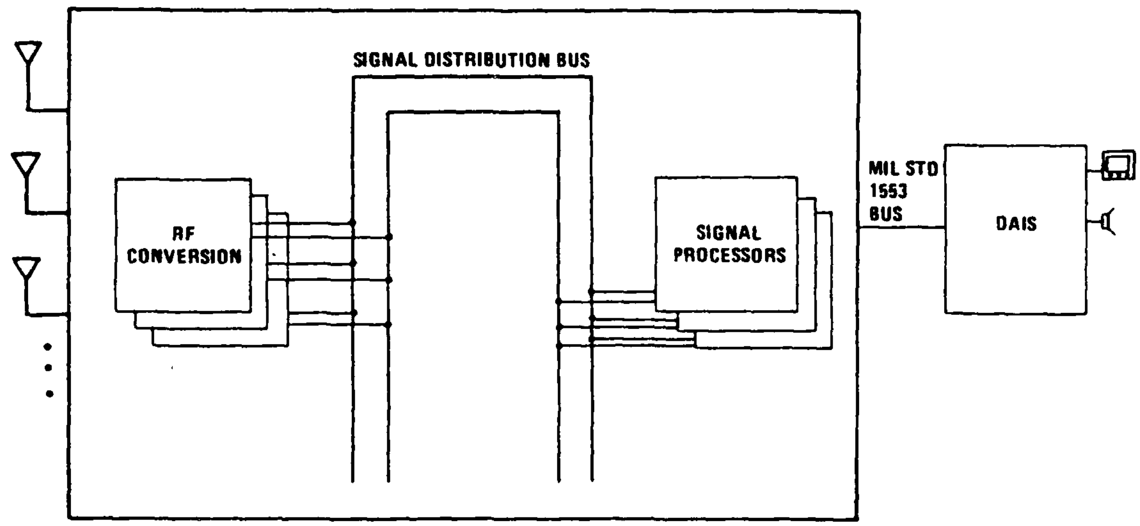

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Figure 1-1. MFBARS

The question of whether or not to integrate the wideband processor with the associated IF modules is not merely an economic consideration. The use of the signal distribution bus enhances the level of self-test and self-diagnosis possible and also allows more flexibility in distributing the wideband resources between the available equipment locations in the aircraft. In order to provide maximum flexibility and future growth capability all integrated architectures investigated (except wideband signals for Architecture 5) use signal distribution buses.

Architecture 4 explores the merits of collocating preamplifiers/power amplifiers with the antennas and utilizing a common RF bus for signal distribution to receivers/transmitters. Architecture No. 6 represents an approach to optimize the antenna/RF interface. Architecture No. 5 takes a hierarchical approach to the distribution of control, partitioning and all other subelements of architecture.

Table 1-1 is a summary of the key features of the architectures. Detailed descriptions and block diagrams of each architecture analyzed for economic merits are given in Section 3.

At the same time the overall architectures were being conceived, different subarchitectures for parts of the MFBARS were being developed such as for electrical power conversion and distribution and for antenna partitioning. The approach led to the identification not only of different overall MFBARS architectures but of important variations of the architectures which were useful in determining the most promising architectures for further analysis during the next phase.

Table 1-1. Key Architectural Features

ARCHITECTURE NO.	KEY FEATURES
1	Discrete
2	JTIDS, TACAN, IFF integrated
3	Integrated, uses FDM signal distribution bus
4	Integrated, uses analog RF bus and digital signal distribution bus
5	Hierarchical version of 3
6	Optimized RF/antenna configuration
7	Discrete with common modules

The totally integrated MFBARS architectures were then defined in enough detail to provide realistic input data to the economic analysis Life Cycle Cost (LCC) models. Four different models were used: Price Hardware, Price Software, Price Logistics and the LSC/RLA. It was necessary to define the architectures to the module or printed circuit card level to realistically account for the production cost saving due to the multiple use of modules through the MFBARS. This level is compatible with the level at which form, fit and function will be specified during the next phase. The total LCC for each architecture was obtained by combining the hardware acquisition cost, the software acquisition cost and the logistic support costs.

The LCC is only one of the evaluation criteria that were used to compare the benefits of the totally integrated MFBARS architectures with the totally non-integrated baseline configuration. The result of the comparison is a recommendation of the totally integrated architectures to be defined in more detail during the next phase. We determined that the main influence on the architecture selection derived from the antenna/RF areas since this is an area which represents more than 50% of the cost (assuming 1985 technology) and cannot be expected to improve nearly as fast as digital LSI circuitry and electro optics.

Our Architecture 6 is aimed at maximizing performance and minimizing cost in this area. It makes extensive use of standard modules, where each module contains a microcomputer for distributed processing in accordance with our hierarchical approach. Each module is self-contained in that it has all the software and hardware necessary for built-in test, diagnostics, control, and interfacing with the control bus. A signal distribution bus which connects the LRUs in the various equipment locations provides a simple method for adding and deleting equipment to the MFBARS system. Architecture 6 uses a minimum of antennas and still provides omnidirectional null-steering (aided by antennas of opportunity) and an RF/antenna interface with less hardware and better performance than any of the other architectures.

Our close cooperation with our Fort Worth Division during Phase I of the MFBARS Study has resulted in a good understanding of the present and future CNI requirements for tactical aircraft in general and F-16 and F-111 in particular. Our in-depth economic analysis of the MFBARS architectures has provided us with an insight into the cost drivers. The techniques and procedures developed for performing the cost analysis will be directly applicable to the further definition and trade-off analyses required during the next phase.

The Phase I study has also allowed us to gain access to information on technology developments that will provide the low risk, mature technology base for design and development of the MFBARS starting in 1985. This access provides the necessary background to continue to improve our of understanding of technology developments during the next phase to support the preliminary design and specification development.

2. MFBARS ARCHITECTURE DEFINITION

Our top-down approach to the definition of innovative MFBARS architectures started with the listing of ground rules, assumptions and considerations. Changes were made to this list as the study progressed. This list is presented in Section 2.1.

Another initial task consisted of analyzing requirements documents supplied by AFAL. From the information contained in these documents and in the AFAL letter dated 15 May 1978 a study of signal structure commonality and time-sharing was made. Results of this study are documented in Section 2.2 and were used as requirements for establishing the specific configuration of the MFBARS architectures.

During initial efforts to derive MFBARS architectures it became evident that two levels of architecture exist: the overall system level and a functional subsystem level. Thus, in addition to attempting to derive overall architectural configurations, we also defined architectures for functional subdivisions of MFBARS such as antennas, RF conversion, signal processing/detection/modulation, control, internal bus structure, built-in-test (BIT) and electrical power distribution. The alternative architectural approaches and implementation considerations for each of these functional subdivisions are described in Section 2.3. Each of the subsystem level alternatives were analyzed for their impact at the overall architecture level to be sure that no significantly different overall architectures were overlooked.

Where subsystem level alternative configurations appeared to have no significant cost or performance effect on the overall architecture, one of the alternatives was chosen to be used to each of the overall architecture definitions. The identification of alternate subsystem level architectural configurations and implementations not affecting the overall architectures for the purposes of Phase I trade-off studies will be used during Phase II for the design trade-off studies.

2.1 GROUND RULES, ASSUMPTIONS AND CONSIDERATIONS

a. Consider at least the functions listed in Table 2.1-1. Add other functions if they are required.

b. Consider growth to make all MFBARS functions secure and jam-resistant.

c. Modules should be common, time shared, and standardized for low life cycle cost (LCC).

d. Goals are:

Reduce LCC	13-25%
Reduce size	15-50%
Reduce weight	10-30%

Reduce power	10-15%
Common modules between systems	50-60%

e. Need unconstrained, innovative approaches that are cost-effective.

f. Consider configurability to meet individual mission requirements and constraints.

g. Consider common signal processing algorithms or common mechanisms of similar algorithms.

h. Identify expected technology advances.

i. Front end and/or antenna repartitioning.

j. Describe several alternative architectures.

k. Assume interface with DAIS Remote Terminal or Bus Control Interface Unit.

l. Do a preliminary economic analysis on alternative architectures, assess technology requirements and risk.

m. Consider application and principles of COMSEC in modular concept.

n. Develop rationale for evaluating approaches to select those for consideration in Phase II.

o. Consider hardware versus software, analog versus digital.

p. Consider programmability for adapting to changing doctrine, functional needs, signal format, threat characteristics, operational disciplines.

q. Consider graceful degradation.

r. Consider throwaway repair concept.

s. Consider trend to replace software by firmware/hardware.

t. Consider modification of RF characteristics by control software (bandwidth, sensitivity, etc.).

u. Automatic entry and exit from communication networks.

v. Compatibility with existing avionics and systems currently in the development stage.

w. Detect data transmission errors and automatically correct errors.

x. Interoperability with U.S. Civil Air Traffic Control and European Air Traffic Control Systems.

y. Use DoD approved higher order language.

z. Hardware sharing will not limit aircraft operational capability.

aa. It is not necessary to satisfy all users completely.

ab. Consider SEEK TALK as a retrofit.

Table 2.1-1. Baseline Functions Derived from Hardware Baseline

1. Position (3D) and velocity determination from whatever "beacon" environment available (Precision: GPS "x")

   (i) Absolute

   (ii) Relative

   (iii) Downgraded to reflect availability of external signals to precision available from external system (e.g., R Nav)

2. Automatic responses to external interrogations (962-1215 MHz)

   (i) Identification in MK XII modes 1-4 (1090 T, 1030 R)
   (ii) A/A TACAN interrogation
   (iii) RTT requests
   (iv) "Technical" acknowledgment to all msg. requiring pilot response.

3. Receive selected signals in accordance with appropriate format, modulation and net protocol as follows:

   a. (i) JTIDS (IJMS) in TDMA format (implies 8 simultaneous frequency channels)

   (ii) JTIDS signals in DTDMA format up to max constraint of 8 channels for (i)

   (iii) TACAN ground beacon responses to (a/c interrogation)

   (iv) All MK XII interrogations

   (v) AJ voice and command voice transmissions

   b. Performance requirements shall meet the equivalent rates, thresholds, error, etc., values of the parent single function hardware.

   Exception: If time-sharing of resources between systems is used, a 10% increase in system function "countdown" (countdown, msg, loss rate, etc.) may be considered equivalent.

   c. With the exception in b., the performance shall be required to be functionally the same as that achieved by having independent JTIDS, TACAN, MK XII and SEEK TALK hardware simultaneously in the switch-on/active mode.

4. Receive selected signals in "conventional" modes (signal BW constrained to 25 kHz) is the 2-400 MHz portion of spectrum; as follows:

   a. (i) On "guard" channels, one in each of the 2-30, 30-88, 108-156, 156-174, 225-400 band allocations.

   (ii) On designated operating channels: 2 in the 225-400 MHz band, one in each of the other bands.

Table 2.1-1. Baseline Functions Derived from Hardware Baseline (Continued)

5. Transmission of required signals in the JTIDS, TACAN, IFF and AJ voice formats as required. See note 3(b), 3(c).
6. Transmission on at least one channel corresponding to the receive capability in (4).
7. The ability to select, and/or preprogram channels and information transfer functions as required in the systems identified in (1)-(4).
8. The ability to sense conditions of link degradation (jamming and module failure).
9. The ability to automatically reprogram and/or provide actions for pilot reprogramming of module configurations to meet the conditions of the mission segment.
10. Flexibility to add preprogram and select algorithms to provide functions of DABS and derivative, MK XII improved, SINCGARS, PLRS, PELS DME link, radar altimeter, direction finding, relaying.

ac. Consider signal seeking receiver for guard bands for VHF and UHF.

ad. Consider growth to include EW and radar.

ae. Consider selective, programmable scanning for land/channel activity.

af. Consider PLSS capability.

ag. Primary consideration is application to new aircraft equipped with DAIS-oriented on-board avionics suite. Secondary is retrofit.

ah. Determine sensitivity of the architecture of different levels of simultaneity of capabilities, do not try to determine the most effective mix.

ai. Put significant effort into trade-offs related to functional modularity.

aj. Consider alternate port for interface with other avionics where throughput rates or time delays are not compatible with the DAIS 1553 bus concept.

ak. Consider partitioning of processing between MFBARS and other avionics with microprocessors embedded in MFBARS.

al. Identify technology areas where early attention and effort can provide fallout benefit to other Air Force efforts.

am. Give specific attention during the definition phase to the sensitivity, of the architectures considered, to modularity at several levels of physical packaging (LRU, SRU, subassembly, card, device) and modularity by function or subfunction attribute (e.g., frequency band, modulation type, number of simultaneous operations, etc.). The purpose is to be able to answer questions such as "What functions drop out naturally as a function of modularity and what is the associated cost saving from dropping such functions?" Or "Which modules, if any,

can be eliminated with significant savings in cost and minimum degradation from a full-up performance level?"

an. Assume design to meet MIL-E-5400 Class 2X environmental requirements.

ao. Provide electrical performance equivalent to that of the individual functional black boxes in Table 2.1-2.

ap. Modularization should consider Tempest requirements.

aq. Consider an embedded microprocessor concept as an alternate to the current DAIS federated processor approach.

ar. Compare other MFBARS architectures with MFBARS architecture to determine advantages for MFBARS. Use LCC models.

Table 2.1-2. Single Function Hardware List for Baseline Architecture

UHF Radio	ARC 164
VHF Am	ARC 115
VHF Fm	ARC 131
HF	ARC 154
ILS/VOR	ARN 108
Transponder	APX 101
TACAN	ARN 118
Interrogator	APX 81
IFF Crypto	KIT-1A
Comm. Crypto	KY-28
Panel C/D's	Appropriate to each System
JTIDS - Class II	Draper JTIDS[1, 3]
GPS - X Set	Draper GPW[1]
SEEK TALK	TBD[2]

1. These are "single-function" implementations of JTIDS, GPS.
2. SEEK TALK includes the capability to operate in an ARC 164 mode, implying dual ARC-164 capability when SEEK TALK mode not used.
3. Without TACAN function, without IFF.

as. Do not consider redundancy for flight critical functions as a basic part of the MFBARS architecture. Redundancy should be optional modular growth only. FAA requires only UHF (or VHF) radio, IFF and TACAN (or VOR). On the F-16 the UHF radio, IFF and intercom are the only units on the essential power bus.

at. Consider modular structure to expand frequency range coverage to all frequencies in 2 to 1600 MHz range.

au. Assume the use of the Hughes F-15 radar type packaging.

2.2 SIGNAL STRUCTURE COMMONALITY AND TIME-SHARING

2.2.1 INTRODUCTION

Numerous operational analysis studies (Ref. 1 for example) have shown that much of the CNI equipment, which comprises the typical tactical aircraft avionics, is actually passing information only a small percentage of the time.

All of the information is carried by either amplitude (including pulse) or phase (including frequency) modulation of a carrier. While the details of how the signals are modulated or demodulated may be different for the various types of modulation, the conversion, amplification and filtering process requirements to interface with the antenna differ only in the amplitude and phase linearity required and the modulation bandwidth.

Given the above information it is appropriate to consider how much (if any) degradation in information capability will result from having a system which is capable of performing the functions of the dedicated systems but which is time shared between systems on a demand/priority basis. The key element in making this determination is to establish a requirements baseline in terms of the quantity and type of signals which must be processed simultaneously. For the purposes of this report the requirements were defined by Ref. 2 and for the purpose of discussion conveniently divided into four groups of requirements:

a. GPS – This receives only equipment, normally tracks four signals simultaneously and has a fifth channel to acquire new satellites as they enter optimum location. The receive processing is characterized by very low signal strength and narrowband filtering and as such does not lend itself to time-sharing until after the IF filter.

b. L-Band – These systems include JTIDS, IFF, and TACAN and are characterized by low duty cycle, narrow transmit pulses in the 960 to 1215 MHz range and receivers which must be essentially continuous since their inputs are controlled by outside sources. The transmitter sections of these systems appear to be excellent candidates for time-sharing on a rapid basis. The receiver

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Ref. 1. Requirements Analysis for a Multi-Function, Multi-band Airborne Radio System (MFBARS) ARINC Research Corporation, March 1978

Ref. 2 AFAL Ltr of 15 May 1978, "Transmittal of Information for use Under Contract F33615-77-C-1517

sections appear to be good candidates to occasionally reallocate channels to fulfill peak signal processing requirements to one system.

c. SEEK TALK – This UHF system, employing an adaptive array, does not appear to be a good candidate for high-speed time-sharing. When it is used, it is on a continuous basis. When it is not used, the capability can be used as a conventional UHF transceiver.

d. 2-400 MHz – In this band are the conventional communications systems and ILS navigation aids. Historically, transmissions in this band have been controlled by the pilot on a one at a time basis and thus the transmitters are a good candidate for time-sharing. Normally, receivers are assigned to monitor specific assigned channels and guard channels. Simultaneous signals on more than two or three channels are quite rare. It appears that some time-sharing on a slow basis would be useful for these receivers.

2.2.2 L-BAND SIGNAL STRUCTURE 960-1215 MHZ

This discussion considers the signal structures present or projected for use in the 960 to 1215 MHz band in order to determine the feasibility of sharing common transmit equipment between the various systems which include:

TACAN
IFF Interrogator
IFF Transponder
JTIDS Phase I
JTIDS Phase II
CAS, ACAS, BCAS
DABS
PWI

Since there is little information available as to the final signal form of any CAS, ACAS, BCAS, DABS and PW1 system it is assumed that they will replace one of the other equipments, be backward compatible with the replaced system, and not increase the overall requirements for transmit capability.

A transmit system can be broken down into four basic parts:

a. A subassembly which determines the operating frequency
b. A subassembly which adds the desired modulation
c. A subassembly which increases the output level to that desired
d. A subassembly which accepts transmit requests and establishes user priority

All of the systems considered use a low average duty cycle, high peak power transmitter with required peak power in the same ballpark. The maximum duty cycle for the various systems are:

IFF Transponder	1%	(Mode 4)
IFF Interrogator	0.835%	(Mode 4)
TACAN Interrogation	.735%	(A-A Mode)
TACAN Response	.375%	(A-A Mode)
JTIDS	10%	

It is evident that since the summation of the maximum duty cycles is much less than 100%, there exists a potential to time share a common set of hardware. This potential is degraded by several additional considerations:

a. The transmissions tend to come in bursts and over a short period the duty cycle is much higher than average.

b. All systems except JTIDS require an exact pulse train and loss or timing error of one pulse of a burst destroys all information of the burst.

c. All systems except the TACAN and IFF interrogations are activated on demand from external sources, which do not have any time synchronism.

For those systems which are activated on demand from external sources about all that can be done is to establish some response priority and determine the number and effect of missing pulses or the operation of the lower priority system.

The establishment of equipment priority itself is a very complicated subject since it depends on human preferences, the content of transmitted messages, and the response of the interrogating unit if they fail to receive the expected reply.

There are three systems which are required to reply at the rate and time demanded by an outside unit. These systems are:

TACAN	AA mode response
IFF Transponder	Response
JTIDS	Time Slot Transmission/Round Trip Timing

Numerous strategies are available which might be used to establish priority among these systems. All systems derive a request for transmission from a companion receiver. The purpose of establishing priorities is to prevent the transmission of signals which are of no use to any system and to make maximum use of total time.

If our nomenclature is defined:

Pulse – The smallest individual information element
Burst – The smallest group of pulses which contain a complete message

then some of the possible strategies include:

a. Time of transmission (pulse by pulse) – Under this method the first receiver to request transmission would blank all other requests until its pulse period is over. This method would work well for the TACAN response since its basic unit of information (burst) is only one pulse long. It would also work for the JTIDS system since missing pulses would be corrected by the Reed Solomon encoding/decoding method. It would heavily penalize the IFF transponder where the effort of sending a large number of pulses may be lost because one of the strings is missing.

b. Time of transmission (burst by burst) – In this method the first system to command a transmission would prevent its use by another system for its entire burst period. This method prevents transmission of useless pulses but does not fully exploit the power of the JTIDS error correction or the very narrow burst width of the TACAN reply.

c. System priority (pulse by pulse) – In this method an in-process pulse transmission would be interrupted by a request for transmission from a system having a higher priority. Such a method would ensure full transmission of a particular system, IFF for example. However, there would be some useless transmission of partial pulses. In addition, partial blanking of a string of JTIDS pulses may cause them to become "errors", which are more difficult to correct than "erasures".

d. System priority (burst by burst) – In this method an in-process burst would be interrupted by a request for transmission from a system having a higher priority. This method eliminates most useless partial pulse transmissions and changes most of the "errors" in the JTIDS system to "erasures".

e. Anticipatory priority (pulse by pulse) – In this method the pulse time profile of each system's future requirements is examined and full pulses of lower priority system are blanked when conflicting demands are encountered. This method can eliminate all useless transmissions and causes all JTIDS conflicts to be "erasures". This type of priority system is possible because none of the systems require instantaneous transmission response to an interrogation.

f. Anticipatory adaptive priority (pulse by pulse) – This method is identical to the previous system with the added feature that the recent past history of transmission on lower priority systems are examined and the priorities adjusted to ensure at least a minimum number of responses required to maintain proper operation. This method would prevent the erasure of a large percentage of responses by a chance harmonic relationship of two or more PRFs or by short-term transmissions having much higher than average duty cycle. This method makes near optimum utilization of transmitter time.

It is appropriate to consider the fine structures of the signals to be transmitted to determine what priorities might be appropriate and what type of transmission interleaving might be cost-effective. The description is contained in Table 2.2.2-1.

It appears that because of the narrow pulse sparing and intolerance of the IFF to missing pulses that it is not worthwhile to attempt to interleave pulses within this burst. This is particularly true since the intraburst time available represents only 5.8% of the total interburst period on the average. One possible exception may exist to this general conclusion. The three framing pulse pairs which occur at the end of the emergency mode burst contain almost half of the unused intraburst time. Furthermore, a missing pulse or pulse pair may only modify the user's display and not change the basic data transfer. This possibility should be investigated further.

When operating in the JTIDS TDMA single pulse mode a 10% duty cycle the available time slots consist of:

1560 slots/s	19.6 us wide
121 slots/s	4458 us wide
7 slots/s	7812 us wide

Table 2.2.2-1. L-Band Signal Structure

												DISTRIBUTION OF UNUSED BURST TIME							
EQUIPMENT	I	R	MODE	PULSE WIDTH µS	PULSES PER BURST	BURST WIDTH µS	BURST REP RATE	TX DUTY CYCLE	BURST DUTY CYCLE	PULSE SPACING µS	TOLERANCE TO MISSING PULSES	QUANTITY	WIDTH	QUANTITY	WIDTH	QUANTITY	WIDTH	QUANTITY	WIDTH
IFF TRANSPONDER		✓	1	0.45	7	20.3	1500	1%	3%	2.8	NONE	1	5.3	1	2.45				
		✓	2		14					1.45		1	2.46	12	1.0				
		✓	3A		14							1	2.46	12	1.0				
		✓	C		13							2	2.46	10	1.0				
		✓	4	0.5	37 (A)	74	1500 (B)		11.1%	2.0		36	1.5						
		✓	1 IP	0.45	14	44.85			6.7%	2.9		2	6.3	1	3.95	10	2.45		
		✓	2 IP		15	24.65			3.7%	1.45		1	3.95	1	2.45	10	1.0		
		✓	3A IP		15							1	3.95	1	2.45	10	1.0		
		✓	1E		13	94.25			14.1%	2.9		3	19.85	1	5.35	3	3.95	5	2.45
		✓	2E		28		1040		8.4%	1.45		3		3	3.95	1	2.45	10	1.0
		✓	3A E		14		1500		14.1%			3		1	3.95	7	2.45		
TACAN	✓		AGXS	3.5	2	15.5	150	.1%	5%	12	MAY	1	8.5						
	✓		AGYS			33.5	150	.1%		30	LOSE	1	26.6						
	✓		AGXT			15.5	30	.02%	1%	12	UP TO	1	8.5						
	✓		AGYT			33.5	30	.02%		30	66%	1	26.5						
	✓		AAX			15.5	1050	.73%%	4.1%	12		1	8.5						
	✓		AAY			39.5		.73%		36		1	32.5						
		✓	AA		1	3.5		.36%	.36%				–						
IFF INTERROGATOR	✓		1	0.8	3	3.8	450	.1%	.17%	2	NONE	1	1.2	1	0.2				
	✓		2		3	5.8		1%	.26%			1	2.2	1	1.2				
	✓		3A		3	8.8			.39%			1	5.2	1	1.2				
	✓		C		3	21.4			.98%			1	18.2	1	1.2				
	✓		4	0.4	37	74		.84%	3.3%			36	1.6						
JTIDS TDMA		✓		6.4	128	3354	121	10%	40%	26	MAY LOSE	128	19.6						
DTDMA		✓		6.4	258	NA	RANDOM	10%	NA	RANDOM	50%	–	RANDOM						

(I) = LOCAL TIME DETERMINATION

(R) = REMOTE TIME DETERMINATION

(A) = ASSUMED

(B) = MAY BE POWER LIMITED

AAC001

The percentage of interrogation which would have mutual interference with JTIDS are:

IFF Mode	1	16.2%	TACAN	AA-X	35%
	2	19.3%		Y	41%
	3a	24%		AG X	35%
	C	41%		Y	41%
	4	42%			

Typical Calculation of Mutual Interference of IFF/TACAN Interrogations With JTIDS Single Pulsed TDMA:

The IFF MODE 1 interrogation is 3 pulses covering 3.8 us of time.

Assuming optimum use of time (instantaneous frequency changes, etc.) there are:

	15609(19.6 - 3.8)	=	243500 us/s available between pulses
and	121(4458 - 3.8)	=	538.958 us/s available between time slots
and	7(7812 - 3.8)	=	54657 us/s available in blank time slots

for a total of	837115 us/s total time available
which is equal to	83.7% of total time
thus	16.3% will have mutual interference

It was also assumed that once an interrogation was longer than 19.6 us that there was no chance to use the 15609 time slots 19.6 us long. In general this is true for IFF interrogations since they contain large numbers of closely spaced pulses. It is not necessarily true for TACAN interrogations. Thus for TACAN AAY the time available is:

121 x (4458 - 39.5)	=	534578	
7 x (7812 - 39.5)	=	54404	
Total	=	588982	= 59% available
			41% with interference

Since the actual number of interrogations are limited by both mutual interference and by the interrogator's minimum interrogation spacing it might be more appropriate to consider the maximum number of interrogation opportunities which will exist. For the IFF interrogator with a maximum PRF of 450 interrogations per second the number of opportunities are:

Mode	JTIDS Single Pulse	JTIDS Double Pulse
1	15872/Sec	15753/Sec
2	15872	15753
3a	15872	323
C	263	323
4	263	323

Similarly, the TACAN with a maximum PRF of 1050 interrogation/sec will have the opportunities:

Mode	JTIDS Single Pulse	JTIDS Double Pulse
X	16091	780
AA Y	603	780
AG Y	603	780

If worst case IFF and TACAN responses are added to the time interval in a noninterfering basis they will eliminate 14% and 1% of the opportunities respectively. Thus the number of opportunities is reduced to:

IFF Mode	JTIDS Single Pulse	JTIDS Double Pulse
1	13390	13390
2	13390	13390
3a	13390	283
C	226	283
4	226	283
TACAN X	13677	663
AA X	512	663
AG Y	512	663

These numbers appear more than adequate to perform the required interrogations and no barrier exists to a time-shared transmit system except hardware limitation.

In implementing the power amplifier portion of the L-band transmitter the hardware must account for variation in peak transmitter power and different rise and fall time requirements as outlined in Table 2.2.2-2.

Historically, the method used to generate these signals in dedicated equipment has been to use a pulsed oscillator class C amplifier combination for the IFF set and a plate-pulsed amplifier for the TACAN set. In general, the IFF approach will not be suitable for the TACAN application since the class C amplifier will normally cause a short rise and fall time because of its nonlinear input/output characteristics.

One method to overcome these problems would be to replace the class C amplifier with a linear. This, in combination with a linear voltage variable attenuator, will produce an exact replica of the modulation input. This method is not desirable because of the increased power dissipation caused by the linear amplifier.

A more satisfactory approach would be to use a combination of low level of a signal source followed by high level modulation of a saturated class C amplifier. Such a configuration would provide good control of both peak power and pulse shape.

Table 2.2.2-2. L-Band Transmit Signal Characteristics

PARAMETER/ SYSTEM	PEAK POWER KW	PULSE WIDTH μS	RISE TIME μS	FALL TIME μS	FREQUENCY MHZ
JTIDS	0.2/0.8	6.4	0.1	0.1	960-1215
IFF Trans.	0.5	0.4/0.8	0.1	0.1	1090
IFF Int.	1.0/2.5	0.4/0.8	0.1	0.1	1030
TACAN	0.5/2.0	3.5 $\pm$0.5	3.5 $\pm$0.5	2.5 $\pm$.5	962-1213

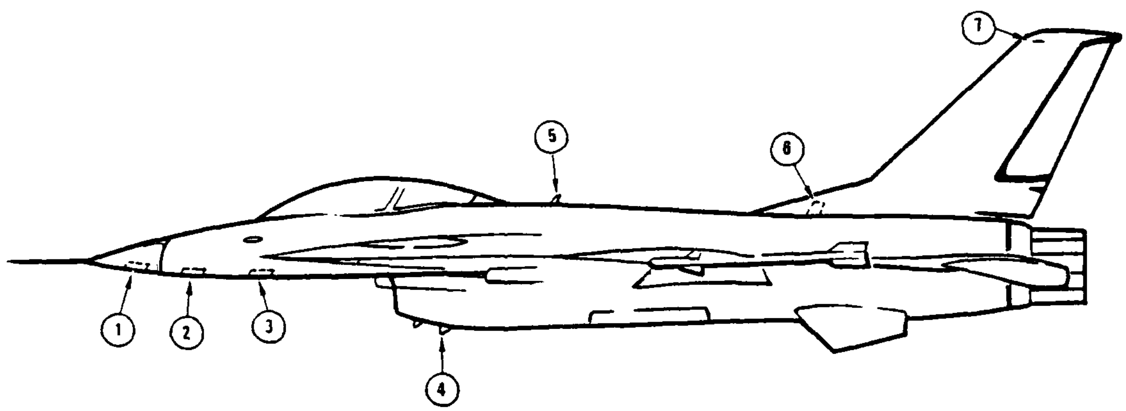
2.3 ARCHITECTURAL CONCEPTS

The following paragraphs describe alternate configurations and approaches for MFBARS functional subsystem elements. Probable technology advances in each area are described. The information presented in this section was obtained partially from external sources such as government agencies, industry and other General Dynamics divisions. These external sources are identified where applicable.

2.3.1 ANTENNA CONFIGURATIONS

2.3.1.1 HF ANTENNA – Aircraft antennas for use with HF communication systems in the 2-30 MHz frequency range are required to yield radiation patterns which provide useful gain in all directions significant to communications. Impedance and efficiency characteristics must be such that acceptable power transfer to the radiated field takes place. As shown in Figure 2.3.1.1-1, the current F-16 antenna complement does not cover HF. Effective excitation of the airframe as an HF antenna can be obtained by electrically isolating a portion of the leading edge of the vertical stabilizer, see Figure 2.3.1.1-2, to provide antenna terminals.

The ARINC study of MFBARS baseline requirements of the MID-1980s indicates HF radio installations for the FAC-X, FOI, RF-X aircraft as well as for the F-16 A/B aircraft among others. The Fort Worth Division of General Dynamics did a tentative installation analysis of an HF antenna on the F-16 with the conclusion that it is possible to implement it.



1. GLIDESCOPE/LOCALIZER ANTENNA
2. TACAN ANTENNA
3. MARKER BEACON ANTENNA
4. UHF/IFF ANTENNA
5. TACAN ANTENNA
6. UHF/IFF ANTENNA
7. VHF ANTENNA

AAC002

Figure 2.3.1.1-1. Existing F-16 Antenna Configuration

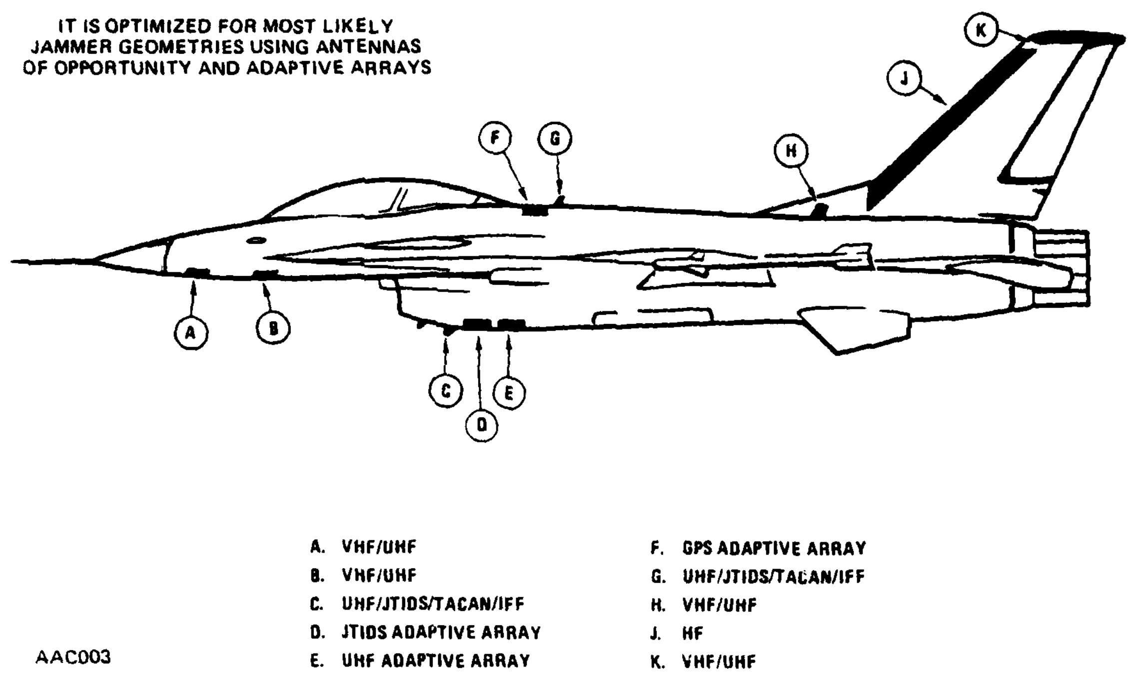


Figure 2.3.1.1-2. Recommended MFBARS Antenna Configuration

Retrofitting antennas on the F-16A is a very difficult and costly task because it would require cable routing through fuel tanks. On the F-16B version, which will be implemented with a dorsal, the cable routing would not be nearly as difficult because increased volume does permit installation of additional equipment. An "Increased Volume" study is currently going on at GD/FW; its purpose is to determine approaches to increase space for additional avionics equipment.

HF antenna installation is a major task to be accomplished by the airframe manufacturer whether as a retrofit or new design.

For HF radio reception only, there are active HF antenna blade assemblies available which measure approximately 9"H X 4"W X 1"D. These antennas are available from Bayshore Systems Corp. as part number 100113. The active device is used for impedance matching.

Small active transmit antennas have also been developed under contract by AFAL under Contract AF (052)-950; however, the RF power handling capability and development status are not known at this time.

2.3.1.2 VHF ANTENNA - In the range of frequencies where the major dimensions of an aircraft are many wavelengths, the design of antennas for omnidirectional coverage is influenced by the airframe structure with respect to impedance and radiating pattern.

Depending on available antenna location the antenna is usually matched in its environment. Because shadowing and reflection by the aircraft structure produce pattern distortion the tip of the vertical stabilizer is the preferred location for omnidirectional antennas covering the VHF and UHF range of frequencies.

As shown in Figure 2.3.1.1-1 there is an existing VHF antenna on the F-16; however, it covers only the 30-76 MHz, and the 118-156 MHz frequency bands.

Discussions with personnel from Dorne and Margolin, Inc. indicate that they are presently evaluating broadband, fixed tuned antenna designs. A full scale engineering model of a communication tail cap antenna, Model DM C93-1, shown in Figure 2.3.1.1-2, has been successfully tested. The antenna provides continuous coverage from 30 MHz to 400 MHz and therefore includes the single channel ground and air radio (SINCGARS) for the Army.

A blade antenna covering the same frequency band is also being evaluated. Since such an antenna has a fairly significant drag its inclusion in highly dynamic aircraft would have to be similar to the existing UHF/IFF blade on the F-16 with the accompanying coverage limitations as a result of shadowing.

The broadband VHF/UHF fin cap antenna can replace the VHF antenna on existing aircraft and it can certainly be designed into new aircraft.

2.3.1.3 UHF ADAPTIVE ANTENNA – A requirement has been established to upgrade the UHF communication systems on aircraft to provide secure speech by means of adaptive antenna systems which operate against a number of jammers and other sources of interference.

Considering the state of the art in low profile microstrip antennas, as developed by Ball Brothers Research Corp., it appears possible that within a year or so multi-element microstrip patch array designs will be available for the UHF band. Since the microstrip antennas are inherently narrowband antennas, say one to three percent bandwidth, depending on the thickness of the dielectric material it will be necessary to electrically tune the antenna element for operation at any channel frequency in the UHF band. Assuming that operating frequencies for a given day are known, it is then possible to tune the antenna elements of the array to any channel since the speed of tuning is not critical.

On small aircraft the array size will have to be kept to a minimum to prevent mounting interference with airframe structural members. We expect that a reasonable goal for the size of a 4-element adaptive array patch should be about 18" X 18" X 0.3".

The number of elements to be used in the array are determined by an estimate of the most likely number of jammers to be encountered during a mission as well as by tradeoffs of cost, weight, and complexity. Here we assume a likely number of jammers to be three, and the array elements to be five. The reason for using a larger array than theoretically necessary is based on experimental data obtained by RADC where it has been observed that compensation of excessive near-field scattering by stores and other irregularities on an aircraft could use up one degree of freedom for null steering.

We argue that the primary jammer threat is from the ground and therefore SEEK TALK is only a bottom fuselage installation. As a five element array it can either null as many as four jammers or if near-field scattering is large only 3 jammers can be nulled and one degree of freedom is used for multipath compensation.

The top hemisphere is covered by the three UHF antennas on the top fuselage providing protection against as many as two jammers. These three antennas are not closely spaced, but are combined for null steering as "antennas of opportunity", that is to say, the antennas at the particular location are used to steer nulls in the best possible manner. RADC's in-house experiments, on a full-scale F-111 and A-10 with just 3 antennas at random locations on the aircraft bottom fuselage, demonstrated that nulls are not as deep using widely spaced antenna elements. It should be pointed out that some of the experiments combined antenna elements mounted on the top and bottom fuselage. The differences in null depth in the horizontal plane may be quite as great when antennas from only one side of the aircraft are used.

Under those conditions where an all-attitude full null-steering capability is to be maintained a second array installation on the top fuselage may be necessary; however, for the purpose of this study an all-atitude full null-steering capability is not considered necessary.

A review of potential F-16 sites for installation of SEEK TALK arrays is shown on Figure 2.3.1.1-1. The most likely areas would be sites B on the top fuselage and F (nose wheel well) on the bottom fuselage. The region aft of site F is used for stores and therefore not available for antennas.

2.3.1.4 JTIDS ADAPTIVE ANTENNA – The JTIDS system requirements present considerable challenges to the adaptive antenna designer because of the wide signal bandwidth and omnidirectional coverage requirements.

Two concepts to provide jamming protection for desired signals with unknown direction of arrival are under consideration. One approach uses a wideband nulling technique and the second approach applies nulling techniques only at four odd number frequencies or at most on all eight frequencies of the frequency hopping scheme. The latter approach may allow sufficient time for a "prelook" for null steering at the next frequency in the eight frequency code. That is to say, while JTIDS operates at frequency f_n the prelook forms antenna nulls against jammers at frequency f_{n+1}. Once the hop to f_{n+1} has taken place the null steering weights for frequency f_n are stored. When the cycle of frequency hopping has reached f_{n-1} then the weights for f_n are recalled and updated prior to the next hop to f_n during the "prelook" time period.

The jamming geometry for JTIDS is assumed to be the same as for SEEK TALK. That is, the number of jammers on the ground is much higher than the number of airborne jammers. In addition groundbased jammers can radiate much higher power levels, EIRP, than is possible with airborne jammers. Therefore the JTIDS adaptive antenna installation uses a closely spaced five element adaptive antenna at the bottom fuselage for null steering against jammers.

An antenna configuration for an arbitrary new aircraft has 3 top fuselage mounted UHF and L-band antennas. These antennas can be combined for null steering against as many as 2 airborne jammers.

From experiments at RADC a closely spaced array of three antenna elements have yielded null depths of 50 to 60 dB. These experiments were conducted on the A-10 and the F-111. Combination of antennas of opportunity has yielded antenna nulls which are

number of simplifying assumptions will have to be made. From discussions with RADC personnel it appears that particularly stores on the aircraft modify antenna pattern coverage drastically. The most severe problem is one in which near-field scattering from stores and other aircraft structures use up a degree of freedom for nulling to compensate these multipath problems.

2.3.1.7 TECHNOLOGY DEVELOPMENT – Rapid advances in digital hardware technology have resulted in increased interest in digital adaptive antennas and methods of faster convergence rates. It is known that rapid convergence can be achieved in adaptive antennas when the variables are independent.

A method of parallel processing for rapid weight computation based on Gram-Schmidt orthogonalization must be explored to the experimental stage to determine the merit of using either pilot signal or power inversion.

It has been shown by analysis and computer simulation that adaptively controlled cascade networks exhibit the capability to provide deep nulls against powerful sources of interference despite hardware imperfections in the system. Simulation results also indicate that the cascade produces not only deeper nulls, but it also has superior transient response. A very fast loop response achieves a good solution in a few samples.

Therefore hardware developmentof these techniques must be implemented to demonstrate practicality of these approaches described in the literature.

Another difficulty which requires further experimental verification has to do with the problem of lack of resolution with closely spaced antennas and the grating lobe problem when combining widely spaced antennas of opportunity on an aircraft. RADC has limited experimental data on adaptive beamport and multilevel sidelobe cancellers. The applicability of the technique with fewer antenna elements, perhaps in an interferometer arrangement of the elements should be explored with unequal element spacing. To achieve maximum resolution the elements must be sidely spaced, but not so wide as to make it impractical for aircraft like the F-16 to null effectively jammers in close angular proximity to a desired signal source.

The requirement to provide HF transmit and receive capability on small fighter aircraft is a difficult one because airframe dimensions are small in terms of wavelengths. This requires development of electrically small active transmit antennas with significant RF power handling capability.

Present HF antenna systems which are considered "small" still require a trailing wire for proper excitation for small aircraft. In addition the antenna coupler weighs from 20 to 30 lbs. Neither of these features is acceptable for fighter aircraft like the F-16.

2.3.1.8 UP-COMING IN-HOUSE MFBARS ANTENNA STUDIES – A number of company sponsored research programs proposed for 1979 aid MFBARS required technology development directly. Among them are interference rejection antenna techniques using an existing six channel digital processor based on the LMS algorithm for nulling experiments in complex aircraft environments, e.g. aircraft with stores. Rapid convergence and deep nulling techniques using Gram-Schmidt orthogonalization and adaptive cascade networks are also to be explored and the required computer architecture derived.

For these experiments a five element array of low radar cross section consisting of flush mounted conformal microstrip antennas will be developed.

On another IRAD program A/J capability will be developed by a very low sidelobe antenna design. In addition an angle filter will be further developed which when mounted in front of an antenna reduces sidelobe levels for both colinear and cross polarized signals.

It is anticipated that some communications links on future aircraft will take advantage of operating at a frequency in the atmospheric absorption band to provide secure communications. Absorption band communications links have a very rapid fall-off in signal as range increases thereby providing essentially covert data and voice links over specific ranges. In fact, for any particular weather condition and operational range a user could use the variation ofa tmospheric attenuation and chose the appropriate frequency.

A number of technology developments embracing all aspects of a mm wave communications link are required.

2.3.2 RF CONVERSION

The RF conversion as discussed herein includes all functions historically found between the antenna port and the subsystem which either extract or add modulation from/to the carrier. These functions include multiplexers, low-noise preamplifiers, frequency converters, synthesizers, IF amplifiers, power amplifiers, PN coders, adaptive array element weighting controllers, etc.

We have attempted to consider unconventional system configurations, however, some have such immature technologies that it is difficult to project cost or performance or where the technology is better known there is significant performance degradation. As an example, the use of a digital signal processor directly at the antenna to receive the signals in the 2 to 88 MHz band was considered. In this configuration, a tuned preamplifier would be used to raise the signal level to the point where the analog signal sampling and A/D conversion would be feasible. The preamplifier would have a bandwidth of about 5% and a shape factor of 3 to 1. To handle such a signal severely effects the processing speed requirements in the signal processor.

As an example, it is desirable to sample and quantize the received RF signals as close to the antenna as possible because this will minimize the RF and analog hardware. We considered a tuned amplifier front end for the 2 to 88 MHz band which would have sufficient gain to raise the signal level to a point where analog sampling and A/D conversion would be practical. The preamplifier would have a bandwidth of about 5% and a shape factor (3 dB to 60 dB) of 3 to 1. The resulting requirements on the A/D resolution and the speed of the A/D and the signal processor are far beyond the state of the art that can be expected for this century.

The largest 60 dB bandwidth occurs for 88 MHz center frequency and is $3 \times 0.05 \cdot 88 = 13.2$ MHz corresponding to a minimum sampling rate of $2 \times 13.2 = 26.4$ MHz. The A/D would also have to quantize input signals of the order of microvolts that were being interfered by signals which may be as strong as 0.1V. This requires about 20 bit resolution (10^{-6}). A 20 bit A/D operating at 26.4 MHz sampling rate is not likely to be realized

this century. Furthermore this approach requires that the signal processor operate about 400 times faster than otherwise would be needed (64 kHz) which if present trends for speed improvements in LSI circuits continue (10 times improvement every 8 years) would require about 20 years to catch up.

Because of the above, only "conventional" forms of RF conversion were considered and they were of three basic forms:

a. Multiple conversion with a high first IF
b. Multiple conversion with a selected first IF
c. Single conversion with a 70 MHz IF

The first form suffers from performance degradation relative to the other two in terms of noise figure and dynamic range. The choice between the other two is much more difficult. For some bands (in particular HF and UHF) the single conversion would provide good performance at reduced cost. For most bands, however, the single conversion form suffers from performance degradation and design difficulties (increased cost) which make a double conversion with selected first IF the better choice. Some of these difficulties are outlined in Table 2.3.2-1.

Table 2.3.2-1. Alternate Architecture Definition

Baseline:	Double conversion exciter and receiver.
Alternate:	Single conversion exciter and receiver (70 MHz IF)
Impact:	More gain at single IF frequency:
	GPS requires about 140 dB of gain prior to FDM bus. This implies about 125 dB of gain at IF. Difficult EMI problem.
	More severe filtering problem:
	Increases receiver front-end tuning difficulty to attenuate image while maintaining phase linearity.
	Requires device similar to "paratune" to allow simple up-conversion of IF and amplification for transmit signal.
	Non-optimum frequency ratio for spurious responses.
	Limited ability to handle wideband modulation forms.

Overall, if the choice must be made for one form of conversion, it appears that the dual conversion with a selected first IF frequency and a 70 MHz second IF frequency is the best. Appendix A discusses selection of an optimum first IF frequency and identifies spurious associated with the first and second conversion. It shows that for the general octave bandwidth RF input the best IF frequency is 0.43 times the low end of the tuning range using a high side first L.O. and that the spurious responses present with the ratio are tolerable. Also shown are the spurious responses associated with the second conversion and they are shown to be reasonable.

The problems associated with a single conversion system for TV sets are the subject of a FCC funded study[1] and the proposed solution to the problem is a double conversion set employing a low pass, phase linear SAW filter at 346 MHz which is the optimum IF frequency to cover the 800 to 1600 MHz band.

A satisfactory solution to the electromagnetic interference problem involves much more than mere selection of "optimum" IF frequencies. In fact, the problem of colocated antennas is much more difficult. In Appendix B, an attempt is made to define the problem, its magnitude, and to offer ideas as to possible solutions. As yet, none of these solutions appear to be fully mature. The degree to which solutions are required is intimately associated with the amount of antenna integration which is assumed and the amount of antenna coupling experienced which will be unique to each configuration of each aircraft. Lacking proven solutions to the problems posed by Appendix B, the integrated architectures considered employ separate antennas for each band or separate transmit and receive antennas and it is assumed that antenna locations can be found to which will provide the required transmit to receive isolation. It should be noted that the modular concept of the integrated system allows short cable runs between the antennas and preamplifier or transmitter while allowing wide antenna separation.

Inherent in each integrated architecture is a trade-off relative to the amount of switching that should be included to reduce cost and enhance graceful degradation. Appendix C is a comparison of switched versus dedicated configuration for two different capabilities using module increments which are probably about as small as practical. The results indicate that there is no obvious advantage to either form. As the size of the module decreases, it is expected that the cost and reliability impact of the switches would make the switched configuration more expensive and less reliable. Conversely, as the size of the module (or switched increment) increases so that its cost and failure rate is significantly greater than that of the switching elements, then switching becomes more attractive. The exact ratios of cost and failure rate where switching becomes the best form is a subject for detailed investigation in Phase II.

Many factors other than switching effect the choice of optimum module partitioning. Some of these factors are:

a. Each module will contain microprocessor based control and BITE circuitry, power line isolators and conditioners as well as other fixed costs such as connectors, housings, etc. The cost and failure rates of these fixed costs should not be a driver in overall module cost and failure rate.

b. The interfaces with the other parts of the system should be minimized, easy to specify, and easy to test.

c. The range of resources required to complete the module, including personnel skills and plant equipment, should be kept to a minimum.

d. The functional modules created should have broad applications in general electronics equipments.

For some modules, these requirements are conflicting and a trade-off must be made as to their relative importance. The preliminary module list for Architecture 3 is contained in Table 2.3.2-2 and the array antenna element weighting circuitry is one example of a module with conflicting requirements. A typical block diagram is shown in Figure 2.3.2-1. The variety of circuit skills required to complete this module is quite wide, however, the difficulty in breaking into the loop and adequately specifying and testing the I/O parts is more severe. Furthermore, the modules formed by breaking this function into smaller modules would have little stand-alone utility. Thus, it is better to override the desirability to have a limited range of skills in favor of an efficient procurement cycle.

Table 2.3.2-2 also indicates which modules perform similar functions and thus are potential candidates for combining into common modules. Some of these opportunities were used in forming Architecture 6. Table 2.3.2-3 is a comparison of the RF conversion portions of the various architectures. The costs shown represent only the acquisition costs of the hardware and do not reflect subtile changes in fault tolerance, mission effectiveness, etc.

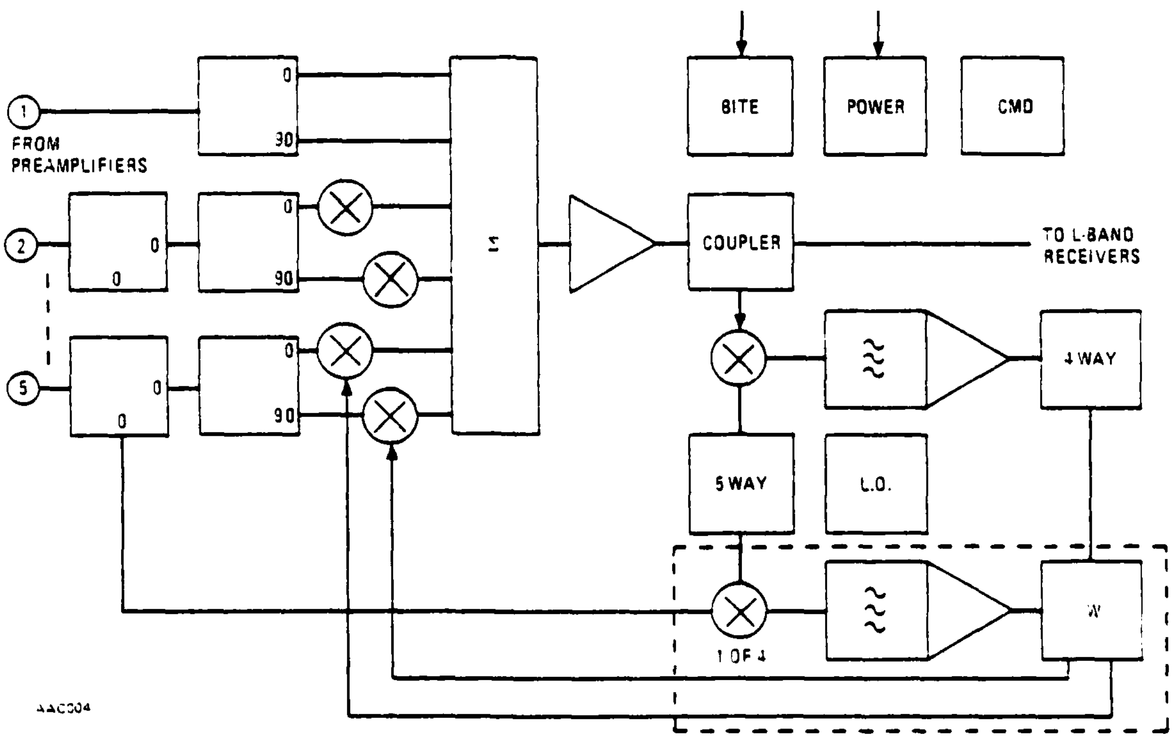


Figure 2.3.2-1. L-Band Element Weighting

Table 2.3.2-2. Architecture 3 Module Complement

MODULE NO.	MODULE NAME	QTY.	FUNCTION	WT.	UNIT COST
1	GPS	5	Preamplifier	5	492
7	Fixed L-Band	4		4	330
8	Tunable L-Band	4		4	462
15	Tunable UHF	5		6	540
22	Tunable VAF-AM	2		2	802
23	Tunable VAF-AM	1		1	939
24	Tunable HF	2		1	1,002
14	L-Band	1	Power Amplifier	12	3,584
17	UHF	2		16	1,318
19	VHF-AM	1		9	1,782
20	VAF-FM	1		7	1,689
21	HF	1		9	1,928
2	GPS	2	Antenna Element Weighting	6	5,200
9	JTIDS	1		8	6,300
16	SEEK TALK	1		2	5,500
4	VAR IF	17	IF Amplifier	17	522
5	70 MHz IF	17		17	500
6	GPS	1	Synthesizer	1	719
10	Fast Hop	2		4	1,175
11	Slow Hop	10		20	765
3	GSP PN Mod	5	PN Modulator	5	663
12	Ant/Select	1	Top/Bottom Switch	1	
18	Exciter	3	Multiband Exciter	5	875

A review of the system acquisition costs shows that the RF conversion subsystem is the major cost driver representing approximately 50% of the total hardware cost. As shown in Table 2.3.2-2, the major cost driver modules in order of decreasing unit cost are:

- JTIDS Phased Array Weighting
- UHF Phased Array Weighting
- GPS Phased Array Weighting
- L-Band Power Amplifier

Table 2.3.2-3. Comparison of RF Conversion Portion of Integrated Architectures

ARCHI-TECTURE	DESCRIPTION	NO. OF DIFFERENT MODULE	TOTAL NO. OF MODULE	TOTAL WEIGHT	TOTAL COST (KS)
3	Minimum Practical Module Size. Very flexible in adding or deleting capability w/o excessive cost penalty. TDM bus for narrow-band signals FDM bus for wideband signals.	23	88	174	70.9
4	As 3 except an FDM bus at the antenna frequency and a digital global bus instead of 70 MHz RDM receive bus.	23	88	174	70.9
5	As 3 except no FDM bus on receivers.	23	88	174	70.9
6	Increased module sizes relative to 3. Fewer antenna interfaces due to integrated antenna. Separate T/R antennas.	18	62	171.8	63.8
7	Dedicated configuration using standard module set of Architecture 3 as building blocks.	23	156	302	111.34

These modules do not necessarily represent the areas where cost reduction efforts should be directed since they are used in limited quantity. The high volume modules which may represent the best return on investment in order of total module cost are:

- GPS Phased Array Weighting
- Var IF
- 70 MHz IF
- Slow Hop Synthesizer

During the next phase of this program, it will be necessary to make more detail performance/cost trade-offs on each module in order to arrive at the optimum system. Since most modules which comprise the integrated system will represent close to the state-of-the-art in many areas, it is expected that the sensitivity of cost to minor specification changes will be very high.

An important consideration in designing all architectures is their ability to readily include additional frequency coverage and modulation bandwidths. The key modules which allow this expansion without excessive cost are:

a. A general-purpose synthesizer which generates an octave bandwidth (250 to 500 MHz for example) and using a series strings of frequency doublers and frequency dividers can generate any frequency desired.

b. A variable IF module employing wideband amplifier elements and user selected bandpass frequency determining elements.

Tables 2.3.2-4 and 2.3.2-5 show the approximate magnitude of the number of RF modules which are saved by using an integrated design, the number of different designs which are eliminated and an indication of how the reduction was achieved. These numbers cannot be translated directly into equivalent cost reduction since a combined module is more complex and costly than any individual module. Furthermore, some of the replaced modules are quite simple and do not represent significant overall cost drivers.

2.3.3 SIGNAL PROCESSING

The signal processing subsystem performs all the necessary functions to translate information between the receive/transmit IF signals on one hand and the display and control subsystem on the other hand. The IF signals are normally exchanged with the signal distribution subsystem and the control and display information is interfaced with the DAIS system via a MIL-STD-1553 data bus.

The RF signals to be processed can be classified into three groups:

a. Narrowband signals
b. Time ordered signals
c. PN modulated spread spectrum signals

Let S(t) = A(t) CO3 (Wot + Ø (t) be a general carrier, where:

A(t) is the amplitude of the carrier,
Ø (t) is the instantaneous phase, and
Wo is the carrier frequency.

Narrowband signals are bandlimited carriers having typically less than 100 kHz bandwidth. All modulation information is contained in the amplitude A(t) and phase Ø(t) which are lowpass processes having bandwidths which are not more than half the carrier bandwidth. Examples of narrowband signals are AM, SSB and FM voice and low speed data. Using bandpass sampling these signals can be sampled at a rate close to twice the bandwidth (rather than twice the carrier frequency) without loss of amplitude or phase information. The relatively modest sampling rate makes it possible to process the information in real time with a digital narrowband signal processor which performs the

Table 2.3.2-4. RF/IF Savings Summary

Transmitter Power Amplifiers:		
JTIDS, IFF Interrogator, IFF Transponder, TACAN	One Design	Save 3
SEEK TALK, UHF AM R/T, VHF-AM R/T, VHF FM R/T	One Design	Save 3
Upconverter		
JTIDS, TACAN, SEEK TALK, UHF-AM R/T, VHF AM R/T UHF-FM R/T, HF R/T	One Design	Save 6
Synthesizers		
All except GPS and Fast Hop Synthesizer	One Design	Save 14
Preamps		
GPS, JTIDS, IFF, TR, IFF INT, TACAN	One Design	Save 4
VOR, UHF	One Design	Save 1
LOC, VHF	One Design	Save 1
MB, VHF	One Design	Save 1
IF AMPS		
All	One Design	Save 12

Table 2.3.2-5. Comparison of Dedicated Versus Integrated Module Complement

RF/IF SUBASSEMBLY	TRANSMITTER POWER AMP		UPCONVERTER		SYNTHESIZER		PN MOD		PREAMPS		IF AMPS		ANTENNA PHASING		TOTAL	
SYSTEM	QTY	DESIGNS	QTY	DESIGNS	QTY	DESIGNS	QTY	DESIGNS	QTY	DESIGNS	QTY	DESIGNS	QTY	DESIGNS	QTY	DESIGNS
GPS					1	1	5	1	10	2	5	1	2	2		
JTIDS	1	1	1	1	8	2			5	1	8	1	1	1		
SEEK TALK	1	1	1	1	1	1			5	1	1	1	1	1		
UHF AM	1	1	1	1	3	2			3	1	3	1				
VHF AM	1	1	1	1	4	1			4	1	4	1				
VHF FM	1	1	1	1	2	2			2	1	2	1				
HF	1	1	1	1	2	2			2	1	2	1				
ILS					3	3			3	3	3	3				
IFF TR	1	1			1	1			1	1	1	1				
IFF IN	1	1			1	1			1	1	1	1				
TACAN	1	1	1	1	1	1			1	1	1	1				
Dedicated Total	9	9	7	7	27	17	5	1	37	14	31	13	4	4	120	65
Integrated Total	4	3	3	1	13	3	5	1	37	7	17	1	4	4	83	20
Savings	5	6	4	6	14	14	0	0	0	7	14	12	0	0	37	45

functions of digital filtering, modulation and demodulation in real time. Such a narrowband signal processor can under software control process several channels simultaneously for different combinations of receive, transmit and modulation modes.

Time ordered signals are pulsed which are characterized by information contained in the time of arrival of amplitude modulated pulses A(t). To this category belong TACAN, IFF and JTIDS. Timing accuracy of better than 0.1 us is required to process these signals. This makes it impractical to process them in a Narrowband Processor since sample rates in excess of 10 MHz would be required. Instead Wideband Signal Processors are used which employ defectors and correlators in combination with fast counters to perform time-of-arrival and decoding functions. General purpose microprocessors can be used to track the time varying delays from different sources of time ordered signals, since these are slowly varying processes.

The third group employs pseudo noise (PN) sequences superimposed on the information carrying modulation. If the rate of the PN modulation is much higher than the data rate the resulting spectrum will be proportionally wider and an improvement in jamming resistance and a reduction in probability of intercept results. For near optimum signal design and hardware the improvement can approach the radio between the PN rate and the data rate. These signals are processed either by narrowband or wideband processors after the PN modulation has been stripped off the carrier. This can be achieved in two basic ways either (1) by use of correlators or (2) by modulating the carrier with the complement of the original PN sequence.

The first approach works well with short PN sequences and can provide accurate time of arrival measurement. Correlation requires that the carrier frequency offset (due to doppler for instance) is much less than the inverse of the duration of any one PN sequence. For JTIDS this translates to

$$\Delta f \ll (6.4.10^{-6})\ \text{Hz} = 160\ \text{kHz},$$

a requirement which is fulfilled for all existing military aircraft. Typical doppler offset is less than 10 kHz for modern tactical fighters. In order to provide enhanced antijam capability systems such as GPS and SEEK TALK employ long PN sequences which require that frequency offsets due to doppler effects are compensated before correlation is performed. For the GPS P code for instance the frequency error must be much less than 50 Hz. The frequency tracking function is normally performed by a COSTAS loop. This function matches the capabilities of a narrowband processor (see Appendix A of the OD proposal). A delay locked loop is used to control the timing of the PN generator which strips off the PN modulation from the received carrier. This loop can be performed by a general purpose microprocessor and does not require the processing power of the narrowband signal processor. It follows that the JTIDS processing is done by the wideband signal processor and the narrowband signal processor performs the GPS and SEEK TALK functions.

The narrowband signal processors are also used for processing the adaptive antenna algorithms.

To achieve good cost effectiveness the wideband signal processor performs all CNI functions using the same time-shared modular hardware. This allows for a flexible easily expandable approach and a high degree of built-in redundancy, which allows for graceful degradation and tolerance of single point failures. The narrowband signal processors do not exhibit these redundancy characteristics and it is necessary to have at least two redundant narrowband processors for each CNI system.

For the cost estimates we have assumed that one wideband signal processor and two narrowband signal processors be used. The cost of the signal processing subsystem is therefore approximately the same for all integrated architectures analyzed and does not have a strong influence on the relative merits of the different architectures.

Three different approaches for signal distribution were included in the candidate architectures.

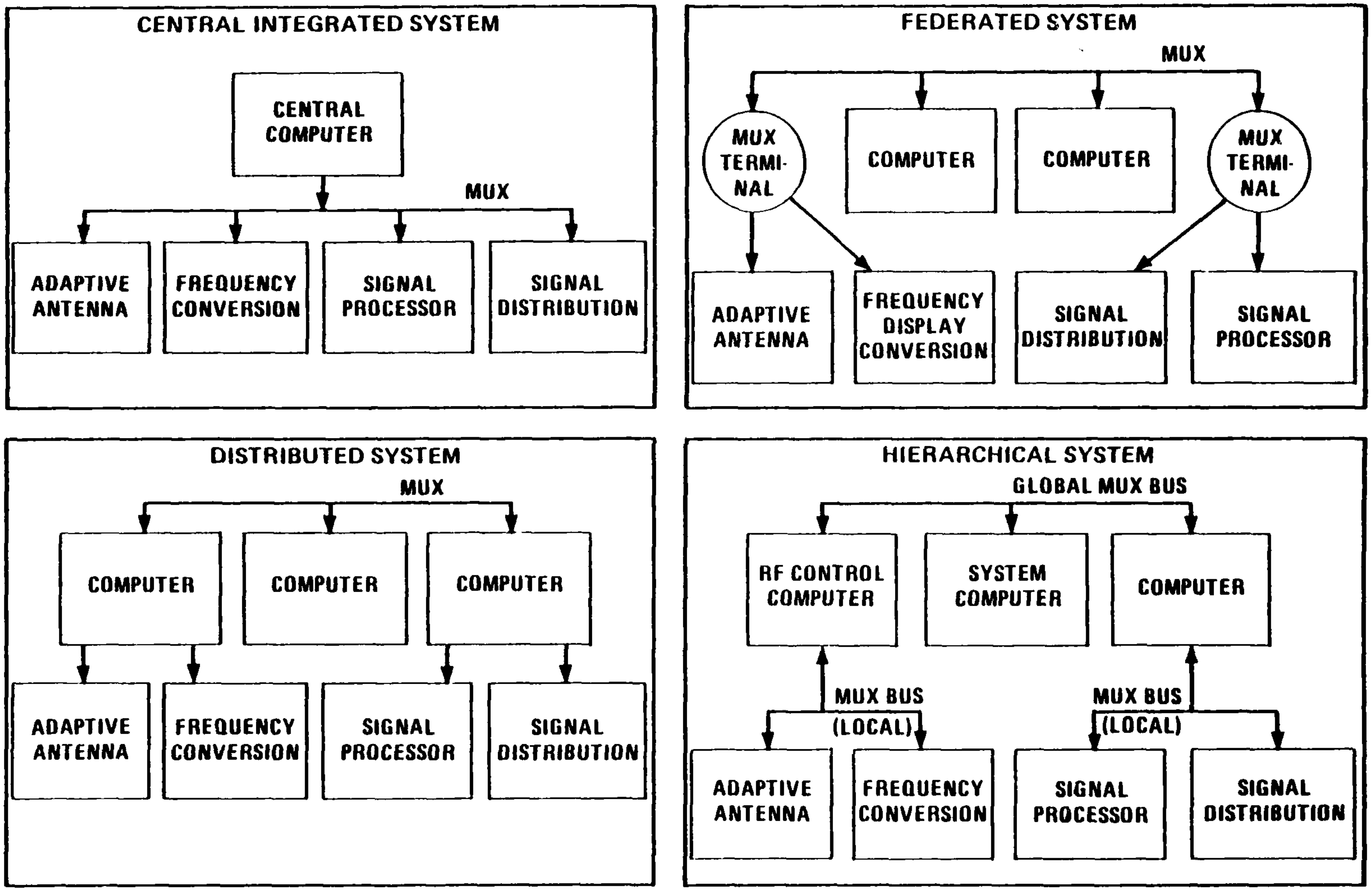
a. FDM for wideband signals and FDM/TDM of narrowband signals.
b. Hardwired wideband signals and FDM/TDM of narrowband signals.
c. Serial digital data bus.

In the first approach each wideband carrier is assigned a unique frequency on the FDM bus and all the narrowband signals are combined in a time division multiplexed scheme and then applied to a single carrier at the FDM bus. The second approach differs from the first in that all wideband IF signals are hardwired to the wideband signal processor. This assumes colocation of the wideband RF/IF and signal processing hardware. In the third approach all IF signals are quantized before they are transmitted to the signal processors as serial digital data.

In all cases the narrowband signal processors receives and transmits IF data in a time division multiplexed manner which exactly matches the input/output requirement of the multiple channel time-shared signal processors. The wideband signal processor receives eight parallel channels of input data for all three signal distribution approaches. This is consistent with the event processor architecture which we used for our cost estimates.

2.3.4 CONTROL AND DATA PROCESSING

Four major types of control and data processing system architectures can be identified as shown in Figure 2.3.4-1. In general, each of the integrated MFBARS architectures have the same requirements for control and data processing. With the development of microprocessors and microcomputers, distributed architectures for control and data processing have significant potential advantages. The configuration selected is a combination of distributed and hierarchical configurations shown in Figure 2.3.4-1. Overall control of the MFBARS is centralized for interface with other avionic subsystems and the aircraft crew. Control functions are then distributed to each module which contains its own microcomputer, which provides for autonomous local control of the functions performed by each module. Thus, BIT can be easily performed for each module by the local dedicated microcomputer resulting in fault isolation to the module level. Other functions would be possible such as automatic scanning of a frequency band or of selected frequencies to detect activity.



AAC005

Figure 2.3.4-1. Control System Architectures

Distributed data processing where such functions as JTIDS relative navigation and GPS position calculations are performed by different microcomputers has several advantages. The configuration can be fault tolerant because failure of a single computer CPU affects only one or a few of the MFBARS functions. Software is easier to develop when a single computer program performs only one function. Maintenance of software is also easier because there is little or no interaction between different functions.

Figures 2.3.4-2 and 2.3.4-3 show the control and data processor configurations selected for the MFBARS integrated architectures for the Phase I study. The configuration shown in Figure 2.3.4-2 is used for Architecture Nos. 3, No. 4 and No. 6. It comprises six microcomputers and two mass memory units. The mass memory units can be used to store computer programs for alternate mission modes or alternate missions, reloading a microcomputer memory, for storing mission data for post-flight analysis, storage of maintenance programs and for any other similar use.

Two of the six microcomputers are dedicated to the data and control interface between the MFBARS and avionic system controls and displays used by the aircraft crew. These microcomputers are redundant and interface between a redundant DAIS data bus on the aircraft side and a redundant MFBARS internal data bus on the other side. These microcomputers will receive commands from the crew via the DAIS system, interpret them, check them for erroneous, conflicting or illegal operations and format them for transfer over the internal data bus to the appropriate module or modules. These microcomputers will also request the proper data from the MFBARS modules for display to the aircraft crew via the DAIS system.

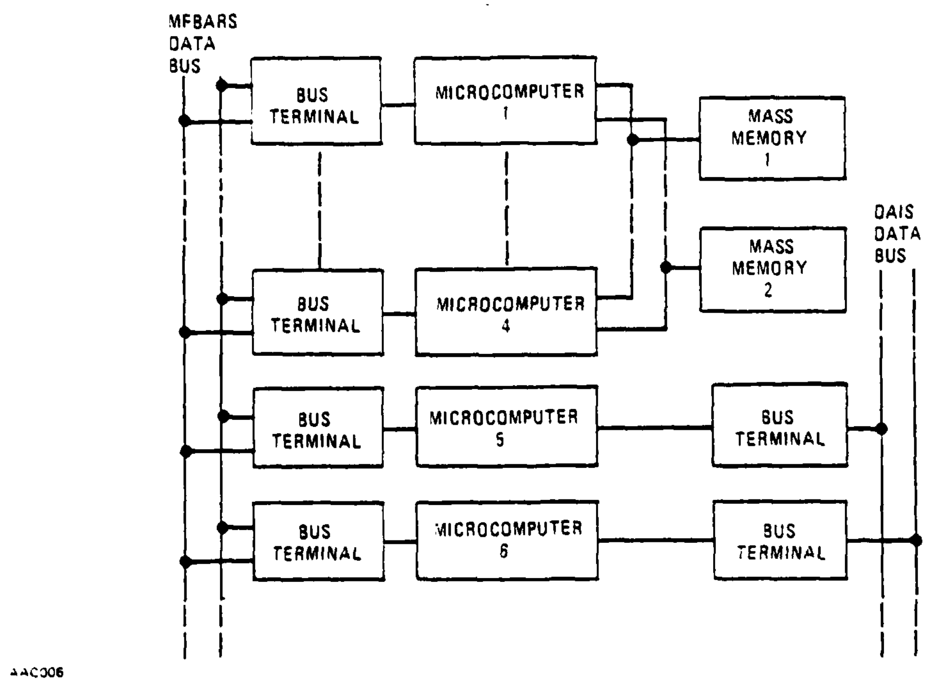


Figure 2.3.4-2. Control and Data Processor Configuration for Architectures No. 3, No. 4 and No. 6

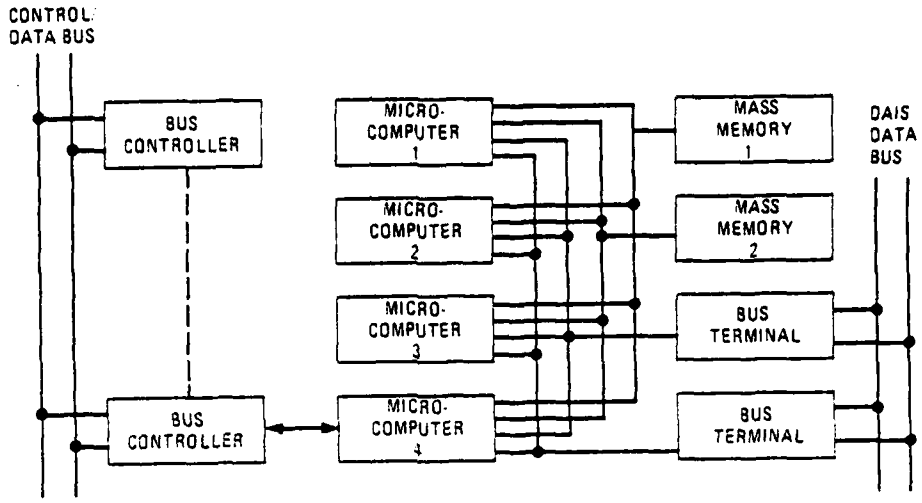


Figure 2.3.4-3. Control and Data Processor Configuration for Architecture No. 5

The other four of the six microcomputers are dedicated to such functions as JTIDS relative navigation, JTIDS message handling and GPS position calculations.

The control bus protocol is assumed to be the same or similar to the requirements of MIL-STD-1553. During Phase II we will consider using a listen-while-talk type of bus communication to eliminate the need for a control bus controller and to make more efficient use of the bus data transfer capability. This new technique has the potential to better distribute the control functions and make it easier to incorporate changes affecting the transfer of data over the bus.

2.3.5 SIGNAL DISTRIBUTION

The signal distribution subsystem serves to distribute analog or digital representations of the IF signals. By employing a set of redundant cables to interconnect all IF modules to the signal processing recourses, a high degree of flexibility is achieved and a significant reduction in the overall quantity of interconnect cables and wires can be achieved. It allows great freedom in physical location and partitioning of the MFBAR system and also facilitates retrofit and implementation of expanded capabilities.

Two classes of IF signals must be distributed in addition to control and self-test information. It is possible to utilize one and the same set of cables for all these functions but by using separate sets of cables for receive, transmit and control/self-test functions, it is

possible to simplify design of the on-bus and off-bus couplers. It also appears cost-effective to segregate the high speed frequency control function for JTIDS from all the other control functions because of the disparity in required data rates.

Present technology trends indicate that fiber optic digital data links will easily handle the digital data requirement for MFBARS in 1985. However, the transfer of analog IF carriers poses a more severe technological challenge since bandwidths of 500 MHz or more are required.

Two classes of IF signals are to be distributed: wideband signals and narrowband signals. The wideband signals are presently JTIDS, TACAN and IFF requiring bandwidths from 0.35 MHz (TACAN) to 7 MHz IFF. Additional wideband systems may be added in the future. Narrowband signals are HF, VHF, UFH, voice and data communication and also spread spectrum signals such as GPS and SEEK TALK if the spread spectrum modulation is stripped off in the RF/IF subsystem. These signals have bandwidths of a few tens of kHz.

For the cost estimates, we assumed that conventional cables were used with either frequency division multiplexed signals or digital data transmission. Because at their relatively low information bandwidth, the narrowband signals can be time division multiplexed before they are applied to the signal distribution bus. Figure 2.3.5-0 illustrates this concept for the FDM bus. Each equipment location has a multiplexer that connects the narrowband IF signals to the associated on-bus coupler in a sequential manner. The multiplexers for the various equipment locations are synchronized so that only one narrowband IF signal is applied at any one time.

In order to further simplify the on-bus and off-bus couplers 70 MHz is used for the FDM frequency F_o. This is the common IF frequency used by all the IF modules. The resulting sequence is shown in Figure 2.3.5-0 as a series of 70 MHz bursts which repeat itself periodically. The sampling rate is high enough so that the change in amplitude and phase is small from sample to sample. The minimum sampling rate F_s is

$$F_s = 2N B_{max},$$

where N is the number at narrowband channels,

B_{max} is the widest narrowband bandwidth.

2.3.5.1 INTERNAL BUS STRUCTURE – Several fiber optic bus configurations applicable to this subsystem have been studied. The four basic concepts can be summarized as follows:

a. Direct-Ring Bus (Irvine Bus) – See Figure 2.3.5-1

This approach utilizes one bus that is connected in series with each communications module. The integrity of the bus depends on the integrity of each of the interconnected modules.

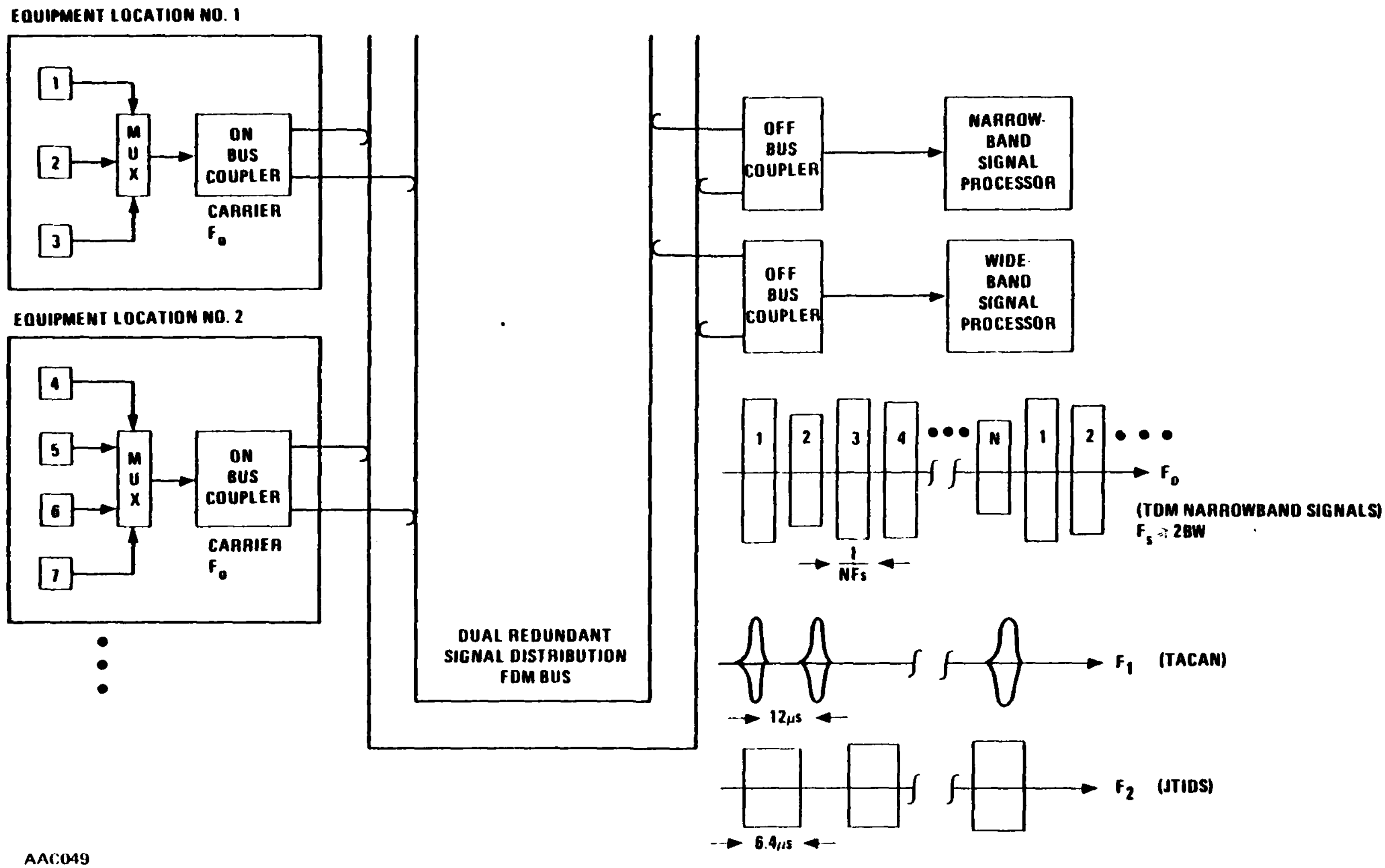
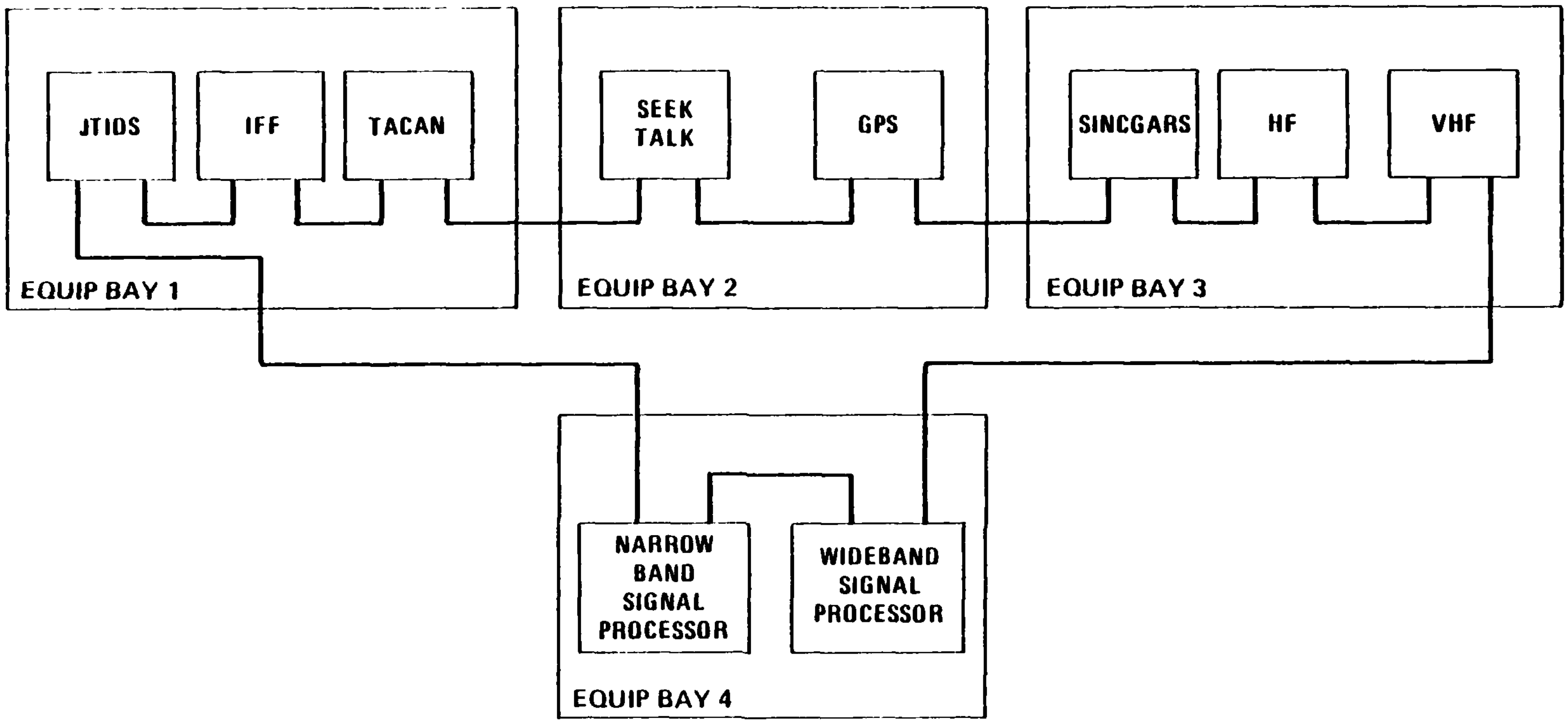


Figure 2.3.5-0. Time Division Multiplexing of Narrowband Signals



CHARACTERISTICS

- NO COUPLERS REQ'D
- MINIMUM AMOUNT OF CABLE
- MODERATE AMOUNT OF DYNAMIC RANGE REQUIREMENTS
- ALL TRANSCEIVERS ARE IN CRITICAL PATH

AAC008

Figure 2.3.5-1. Direct-Ring Bus Configuration

b. Coupled-Ring Bus – See Figure 2.3.5-2

Essentially the same as the Direct-Ring Bus; the modules are coupled onto the bus using access (Y) couplers. Information coupled onto the bus travels in only one direction. T couplers can be used if transmission down the bus in both directions is necessary. Since the bus is essentially module independent, loss or removal of any equipment does not destroy the integrity of the bus.

c. Star Bus – See Figure 2.3.5-3

This configuration utilizes a "centrally located" star coupler for signal distribution. Y couplers located at each module are used for transmit/receive access parts to the bus.

In this configuration, all communicating modules are brought to the coupler when the data is distributed.

d. Hierarchical Bus – See Figure 2.3.5-4

By segmenting the main star coupler into several satellite couplers, reduced cable requirements result. Each equipment bay has its own star coupler for both internal data distribution and communication to the central star coupler for further signal distribution. This configuration still requires the "centrally located" star coupler for inter-bay communications.

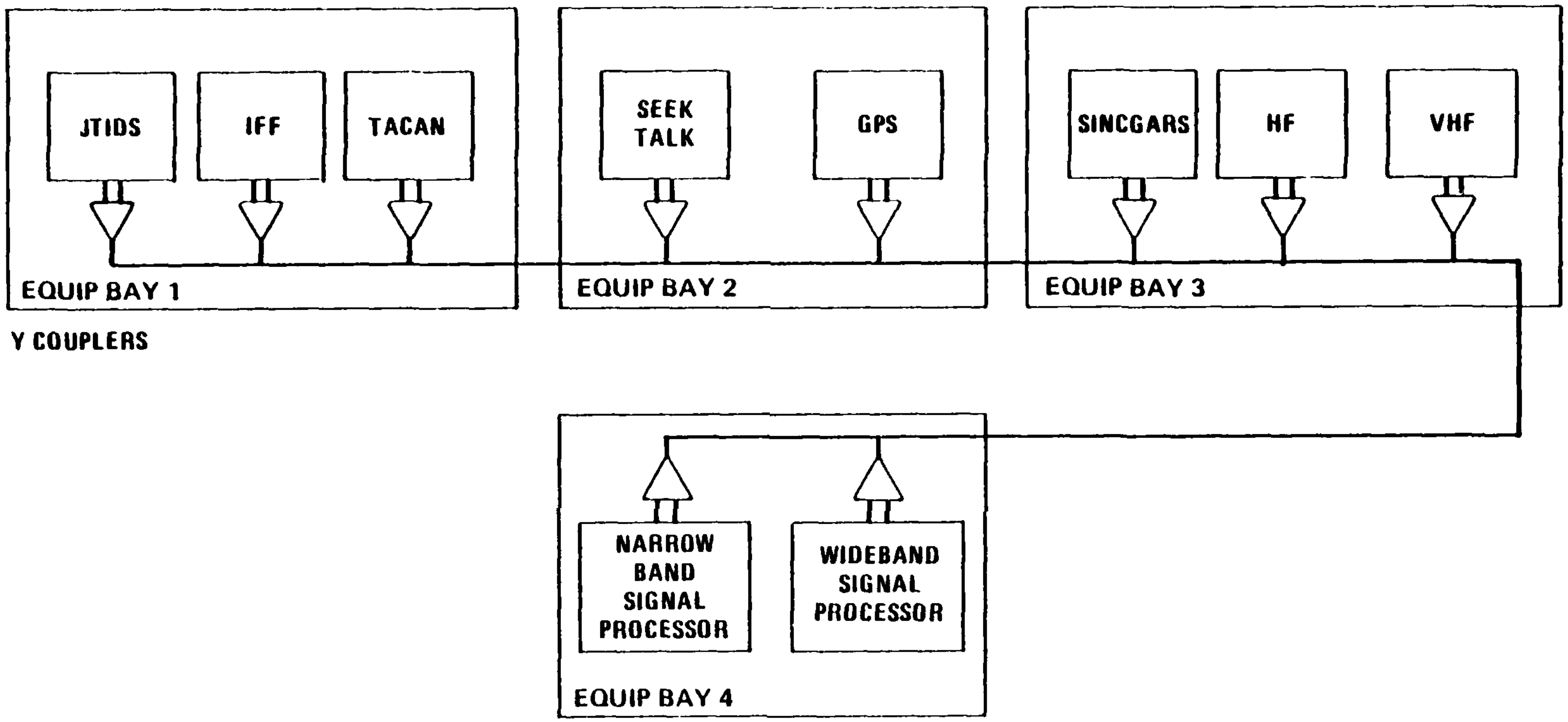
Signal Distribution Requirements and Format

Each configuration has its own merits and deficiencies and in order to select the best approach it is necessary to study the signal requirements and distribution on a more detailed level.

The wideband signals (such as JTIDS, TACAN and IFF), regardless of the basic system architecture, need only be sent to the wideband processor. These signals, however, have the requirement that they be distributed and processed in parallel. An immediate solution to this would be to use eight point-to-point data links. This technique, however, places rather severe restrictions on system expansion. Test modules would need to have access to all eight signals (cables). This approach also requires several bus structures and cannot use a convenient single bus configuration. In view of this, it seems logical to use another technique for transmitting the wideband signals – one that is more compatible with the other hardware in the system.

A technique to accomplish this with a wire bus would be to frequency division multiplex the signals over the same signal bus common to all hardware. This FDM approach requires each wideband signal to be modulated on different carrier frequencies. Individual demodulation at the receiving end would be required to separate the signals. By adapting an optical bus technology, substantial cost savings are expected due to the elimination of the frequency multiplexing and associated hardware.

A fiber optic system, analogous to the wire FDM bus, is a "wavelength division multiplex bus" (λDM). The RF modulations are replaced by fiber optic transmitters with various wavelength LEDs or laser diodes. Diode wavelengths, suitable for fiber optic communication, are presently available in the range from approximately 0.8μm to 1.06μm. As the technology expands and "λ DM" buses become more commonplace,



CHARACTERISTICS

- MINIMUM AMOUNT OF CABLE REQ'D
- MINIMUM NUMBER OF COUPLERS
- LINE LENGTH DELAY VARIATIONS
- LARGE DYNAMIC RANGE REQUIREMENTS

AAC009

Figure 2.3.5-2. Coupled-Ring Bus Configuration

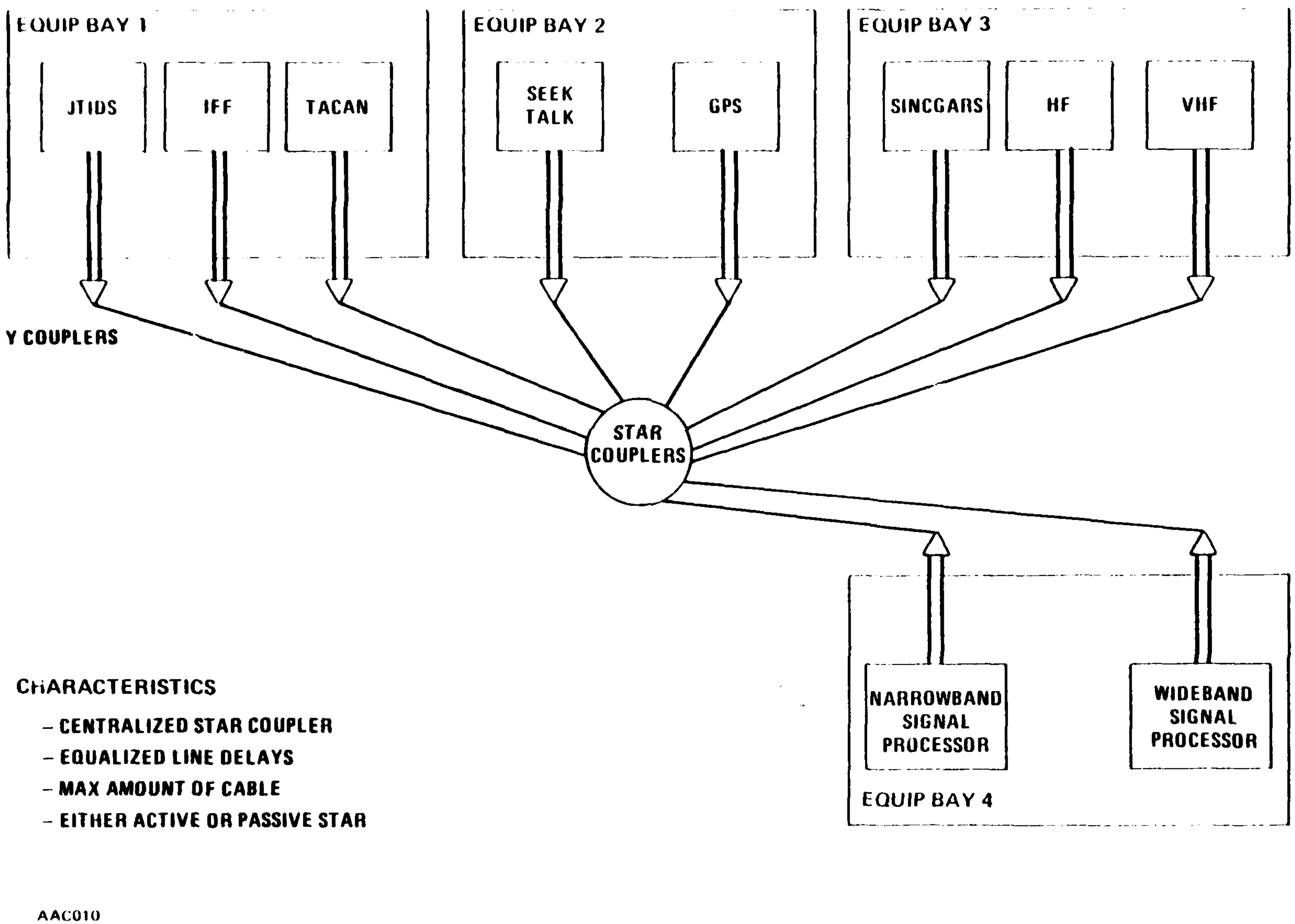
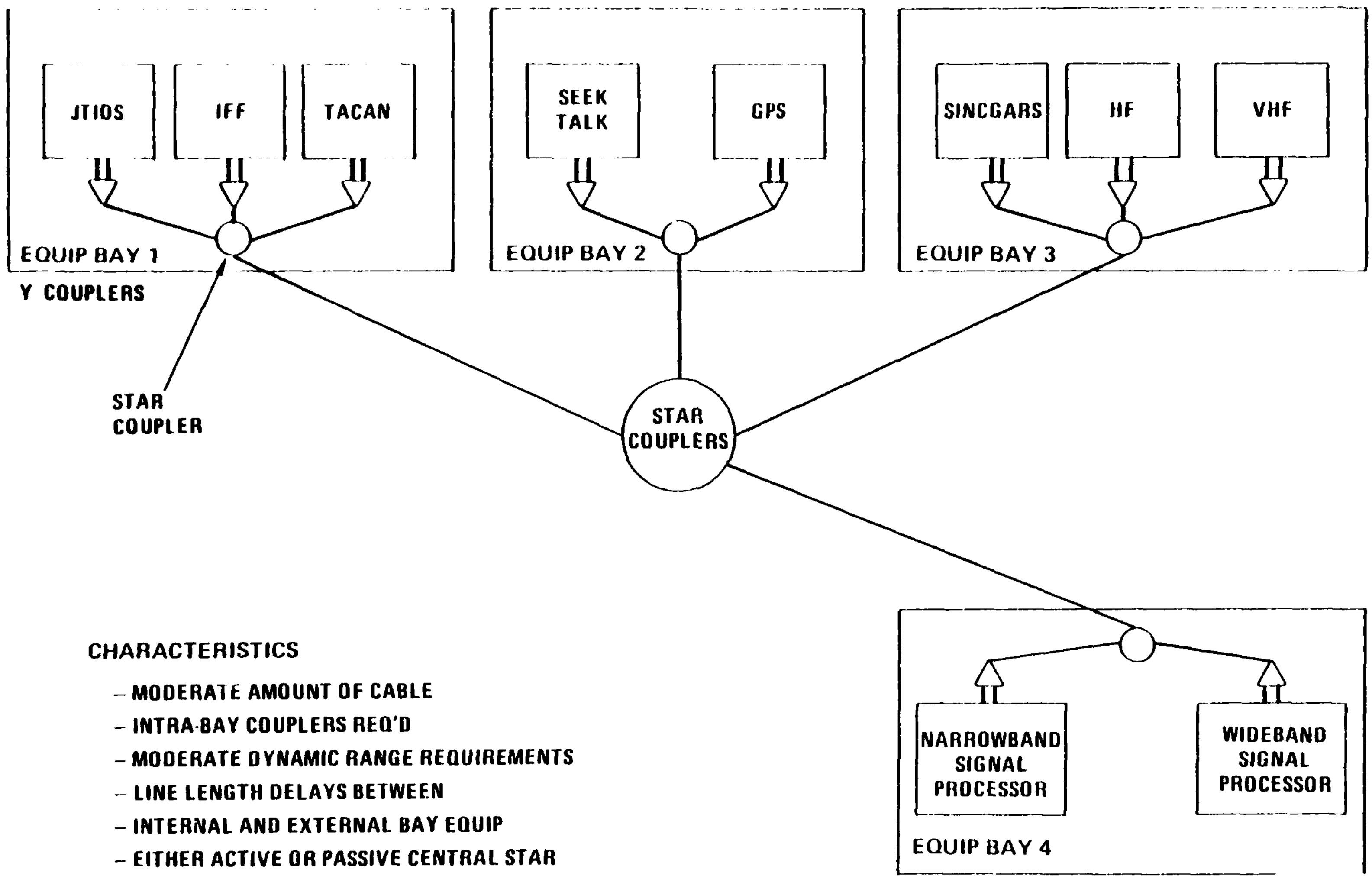


Figure 2.3.5-3. Star Bus Configuration



CHARACTERISTICS

- MODERATE AMOUNT OF CABLE
- INTRA-BAY COUPLERS REQ'D
- MODERATE DYNAMIC RANGE REQUIREMENTS
- LINE LENGTH DELAYS BETWEEN
- INTERNAL AND EXTERNAL BAY EQUIP
- EITHER ACTIVE OR PASSIVE CENTRAL STAR

AAC011

Figure 2.3.5-4. Hierarchical Bus Configuration

greater number of operating wavelengths will be available making the implementation of as many as 10 to 20 signals on a bus relatively straightforward.

These signals, combined in a star coupler, will be coupled onto the main bus via a Y coupler. At the detector end, the various wavelengths would be separated using appropriate filtering mechanisms (e.g., gratings, prisms and optical notch filters). Choice of the filter mechanism would be based on filter efficiency, spectral width and required channel cross talk attenuation.

The distribution of the narrowband signals to the narrowband processors will be accomplished using a standard time-division multiplex format as previously discussed. Techniques for handling such a format are well known and are essentially independent of transmission medium (wire or optical). Any of the previously described optical architectures are acceptable for TDM formats using a single wavelength.

Figure 2.3.5-5 shows a composite block diagram of the various data bus segments previously discussed, compatible with Architecture No. 3.

MFBARS Architecture No. 3 is very well suited for a fiber optic signal distribution system. Architecture No. 5, while very similar to No. 3, is not as flexible as No. 3 because the wideband signals are not put on the main bus. Therefore, access to these signals for any other purpose would have to be done through some other signal distribution mechanism. The basic configuration is a combination of the hierarchical and coupled-ring bus configuration. The single bus feature of the latter configuration was a strong incentive for using it; however, the basic architecture and signal requirements resulted in a modification of the coupled-ring bus system.

The RF receivers are assumed to be distributed in four equipment bays with all wideband signals located in Bay No. 1. Each of these wideband signals modulates a laser or an LED of wavelength λ_1 through λ_8. The narrowband signals modulate on a source at wavelength λ_0.

Since $\lambda_0 - \lambda_8$ signals are present at all times on the cable, adequate filtering means must be used to isolate a particular λ. As previously described, the wideband processor will have an eight channel star coupler with eight receivers sensitive to wavelengths $\lambda_1 - \lambda_8$. The two narrowband processors will have optical receivers sensitive to λ_0. In order for the self-test module to determine the status of all systems, it is necessary that it access all channels. This is accomplished by using a detector which can be tuned to various wavelengths ($\lambda_0 - \lambda_8$) by the use of appropriate optical filtering.

The transmit bus functions in a similar manner to the receive bus with requirements for both TDM and immediate access signals. The inputs to the bus come from both of the narrowband processors, the wideband processor and the self-test modules. Bus outputs go to the three RF exciters.

In order to accomplish the signal protocol, one wavelength is dedicated to each of the processors. These optical channels access the bus through conventional Y couplers. The self-test module will incorporate three separate transmitters with wavelengths λ_1, λ_2 and λ_3. Combined in a local star coupler, this channel also accesses the bus via a Y coupler.

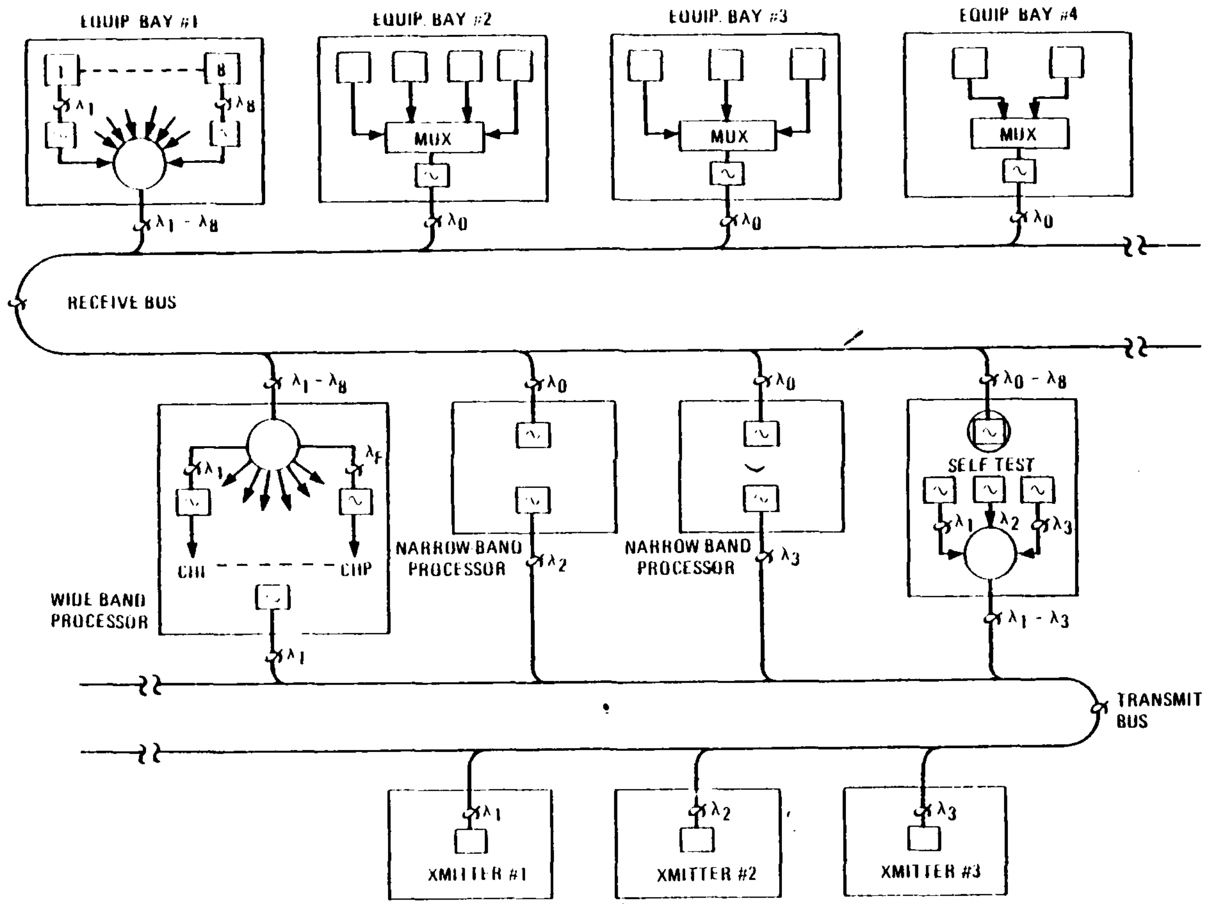


Figure 2.3.5-5. Data Bus Segments

Each of the three RF exciters has appropriate fiber optic receivers associated with them. One of the exciters is dedicated to the wideband processor wavelength (λ_1). The other two exciters are sensitive to both λ_2 and λ_3 either through separate receivers or one with programmable sensitivity characteristics. These exciters can then be switched between each of the narrowband processors. The self-test module, with three separate wavelength sources, can access any one of the exciters for channel testing.

Wavelength-Division-Multiplexing Signal Bus

An optical data bus has the potential of light weight, small size and immunity to environmental hazards over a conventional wire bus. This is particularily true if the optical bus can be Wavelength-Division Multiplexed (WDM), since this is not cost-effective in an analogous way in the RF domain. Device technologies for WDM transmission are sufficiently advanced to consider a WDM data bus in the mid 1980's time frame.

a. Optical Sources

Available materials for semiconductor optical sources and their possible emission region are listed below:

Ga Al As	0.73 - 0.88 μm
Ga As	0.89 μm
Ga In As Sb	0.9 to 1.2 μm
Ga In As P	0.97 to 1.6 μm
Ga In As	0.97 to 1.7 μm

The Ga Al As devices are well established and can be fabricated anywhere in the 0.73 to 0.88 μm region. The other materials are newer (excepting Ga As) technologies, however, experientally as many as three to five different wavelengths have been demonstrated.

b. Detectors

Silicon photo-diodes are fully available from 0.7 μm to 0.9 μm. These devices have low dark current and approach photo noise limited performance. This is not true of germanium photo-diodes which have excess noise and dark current compared to silicon. For this reason, the development of new materials for detectors above 1.0 μm is an important research item for full exploitation of a WDM subsystem.

c. Optical Multiplexers and Demultiplexers

In a WDM bus signals are simultaneously transmitted on a single-fiber by using optical filters for multiplexers and/or demultiplexers. Three types of optical filters, the interference filter, the prism and the grating filter are available as existing technologies for this application. These filters differ in significant properties such as optical loss, number of channels/filter, material cost and quantity production. Based on cost and insertion loss the interference and diffraction grating filters will undoubtedly find major application.

d. System Considerations

A few channels (≈3) can be multiplexed within the 0.85 m wav·'ength region on an experimental basis at the present time. A number of LEDs and laser diodes are available within the 0.85 μm region. This region corresponds with the loss region of the most highly developed cables and silicon detectors (avalanche photo-diodes and PIN diodes).

LED sources are incoherent and their spectral width will result in channel limited performance unless interchannel interference is suppressed both electrically and optically. Laser diodes in the 1985 time frame will become the optimum source device due to their narrow spectral width (less than 0.1 that of an LED) and superior fiber coupling characteristers. In the case of laser diodes, channel spacing will be primarily determined by the temperature characteristics of filters and diodes.

With the development in the 1980s of longer wavelength devices, simultaneous transmission of at least ten to twenty optical channels will be possible in the 0.8μm to 1.6 μm spectral region.

2.3.6 EXTERNAL INTERFACE

A list of MFBARS external interfaces is shown in Table 2.3.6-1. These interfaces will exist for any application of MFBARS to a specific aircraft. Other hardware or data bus type interfaces can be incorporated into MFBARS easily due to its modular partitioning.

2.3.6.1 CONTROLS AND DISPLAYS – All crew controls and displays necessary for mission operation of the MFBARS are provided for within DAIS. All commands originated by the crew controls and all data to be displayed for use by the crew are transferred over the DAIS data bus. The MFBARS normally would act as a bus terminal rather than a bus controller on the DAIS data bus. It is very unlikely that MFBARS would be required to be a bus controller in a tactical fighter aircraft. If such a requirement should exist, it could be accommodated easily by the MFBARS architecture.

2.3.6.2 NAVIGATION AND/OR FIRE CONTROL COMPUTER – The MFBARS will normally interface with the navigation and/or fire control computers on the aircraft via the DAIS data bus. The MFBARS GPS position data would be used to update the inertial navigation system position. Data from the inertial navigation system can be used by GPS for acquisition of the satellite signals and for maintaining lock during high dynamic maneuvers. Position data derived from the JTIDS can also be used to update the aircraft inertial navigation system. Standard messages transmitted by JTIDS requires many different types of data from almost all of the aircraft systems. Normally, one of the aircraft computers (navigation or fire control) would collect the appropriate data for transfer to the MFBARS but it is possible for data from a stores management system, for example, to be sent directly over the DAIS data bus to MFBARS.

2.3.6.3 INTERCOM – The baseline requirement for three concurrent voice channels from any combination of HF, UHF, VHF, AM, VHF FM, SEEK TALK and JTIDS. The MFBARS architectures are not limited to three channels and the number of channels can

Table 2.3.6-1. MFBARS External Interfaces

1.	Aircraft controls and displays via DAIS
2.	Navigation and/or Fire Control Computers via DAIS
3.	Intercom
4.	Electrical power
5.	Cooling air
6.	Physical equipment mounting/cabling
7.	Antenna mounting/integration

be increased by modular expansion. A standard audio level will be provided at the output of MFBARS with the aircraft intercom system providing amplification, volume control and distribution of the audio signals as required by the specific aircraft.

Selection of the three audio channels will be selected by the pilot via the DAIS system. Commands received from DAIS by MFBARS will be executed in the control processor of MFBARS where detailed commands will be sent to the appropriate modules where the actual selection of specific frequencies to be monitored will be accomplished.

The specific MFBARS module providing the intercom interface function will most likely be unique for a specific aircraft type because of different impedance, power level and voltage level requirements. However, a high degree of commonality in design should be possible for all of the different interface requirements.

2.3.6.4 ELECTRICAL POWER – The electrical power assumed to be available from the host aircraft is assumed to be 115 volts, 400 Hz conforming to MIL-STD-704. Other power source types such as 28 Vdc would require only the design of a new set of electric power converter modules. Electrical power distribution, control and the interface with other MFBARS modules would not be affected.

2.3.6.5 COOLING AIR – All MFBARS architectures will require cooling air because of the packaging concept assumed during the Phase I study. Repackaging would be required if cooling air is not available but the module design would not necessarily have to be affected.

2.3.6.6 PHYSICAL EQUIPMENT MOUNTING AND CABLING – The MFBARS architectures defined by the study assume a new type of equipmenting mounting method known as the integral rack concept. The racks are designed to accept plug-in modules and are built into the aircraft structure. The rack design is such that failed modules can be replaced when the aircraft is on the flight line. Built-in-test in each module will identify

a specific failed module with a high degree of confidence. This concept should result in significant cost savings in maintenance costs and spares cost. Each module becomes equivalent to one LRU.

Cabling requirements will be reduced because of fewer interconnections between the different parts of the MFBARS configuration. The use of signal distribution buses and also data and command buses will reduce individual dedicated cables and wires. Functional partitioning of the modules and groups of modules also will keep interconnection wiring to a minimum.

2.3.6.7 ANTENNA MOUNTING – The issues associated with antenna mounting and integration with the aircraft are discussed in Section 2.3.1.

2.3.7 SECURE VOICE AND DATA

General Dynamics recognizes the importance of secure voice and data in military RF systems, where "RF systems" includes secure voice, digital or analog data, IFF, or navigation data. The use of crypto devices increases with each generation of RF equipment developed. Similarly, each new system, i.e., JTIDS, GPS, PLARS, SEEK TALK, has a peculiar data format.

During the next phase of MFBARS, General Dynamics plans to investigate the development of a crypto device which may be developed. The data format of the new device would either be programmable by software of firmware (i.e., ROMS or PROMS). The device then would be full duplex and time shared with the various networks or subsystems on a priority interrupt basis.

The TEMPEST test requirements of NACSEM-5100 and KAG-30A will be studied thoroughly with respect to a tactical aircraft and MFBARS. If found to be justified, modifications (relaxations) to the test limits will be recommended along with the rationale for doing so. Guidelines will then be generated for electronic equipment TEMPEST design. This procedure will assist in minimizing the engineering risk in developing new hardware by preventing overdesign.

In addition to thoroughly detailing the secure communication design, General Dynamics plans to evaluate future equipment capabilities in complying with survivability, vulnerability needs. We feel the MFBARS system design approach must include consideration of all EMX requirements, i.e., EMI, EMC, EMP, TEMPEST, and nuclear hardening. Our design approach will then have evolved after thorough consideration of the total system requirements.

2.3.8 BUILT-IN TEST/PERFORMANCE MONITORING

Various BITE architectures including those depicted in Figures 2.3.8-1 through 2.3.8-5 have been evaluated based on the overall BITE objectives as listed in Table 2.3.8-1. As the content of the module set which comprises the integrated system was defined, it became evident that it would be necessary to keep the cost and failure rate of the BITE circuitry very low. The typical production costs of a module were found to be in the $1,000 area. As a rule-of-thumb, it was established that the module overhead functions which include BITE, power supply isolation and command should not exceed 10% of the

• MODULES PERFORM ALL BITE TESTS AND REPORTS RESULTS TO CENTRAL COLLECTOR

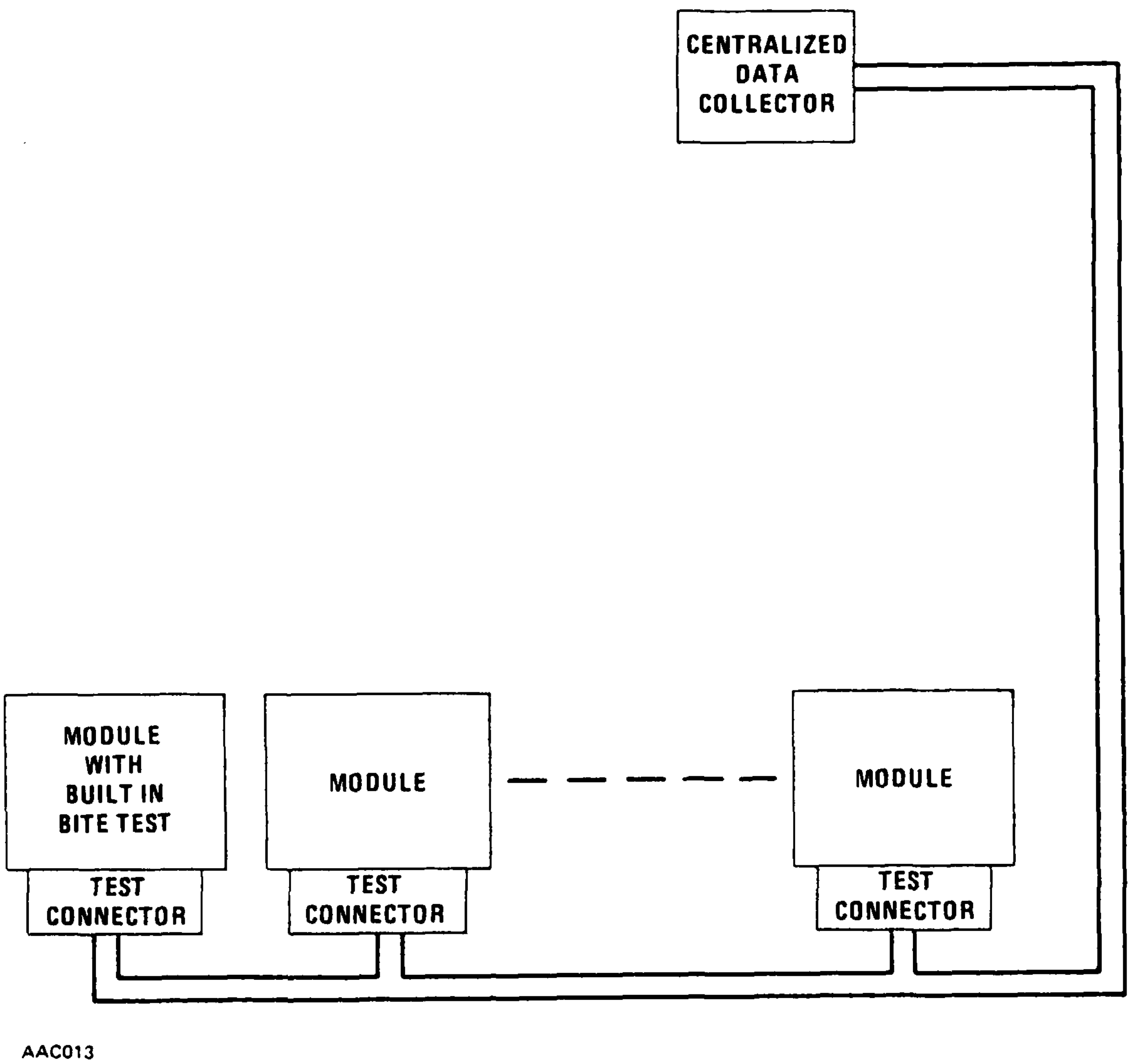


Figure 2.3.8-1. Distributed BITE Concept

- MODULE PROVIDES ACCESS TO CRITICAL POINTS AND SIGNAL SAMPLES VIA TEST CONNECTOR
- CENTRALIZED BITE MODULE POLLS MODULES, PROVIDES EXCITATION SIGNALS AS REQUIRED, MAKES MEASUREMENTS AND STORES DATA

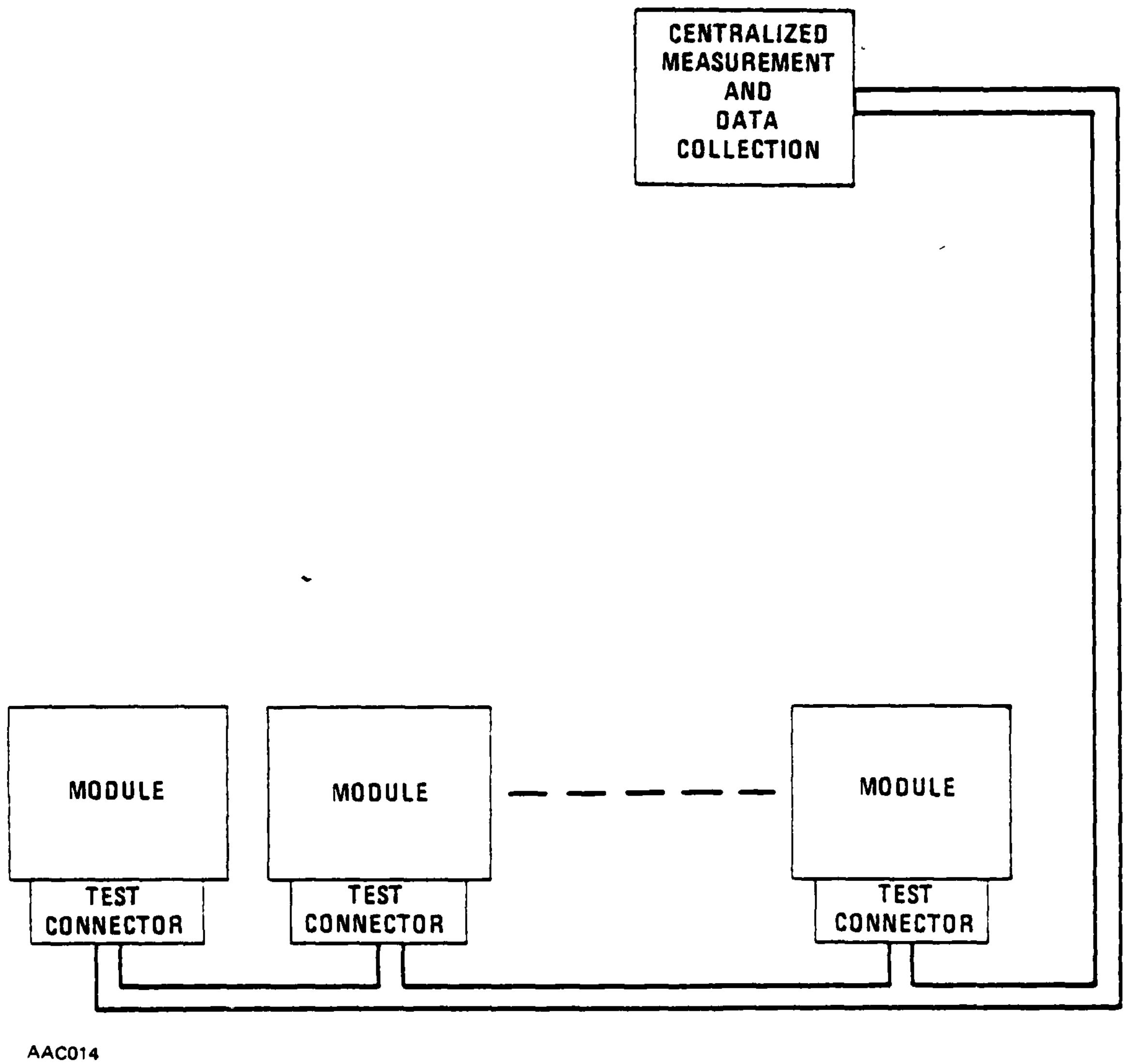


Figure 2.3.8-2. Centralized BITE Concept

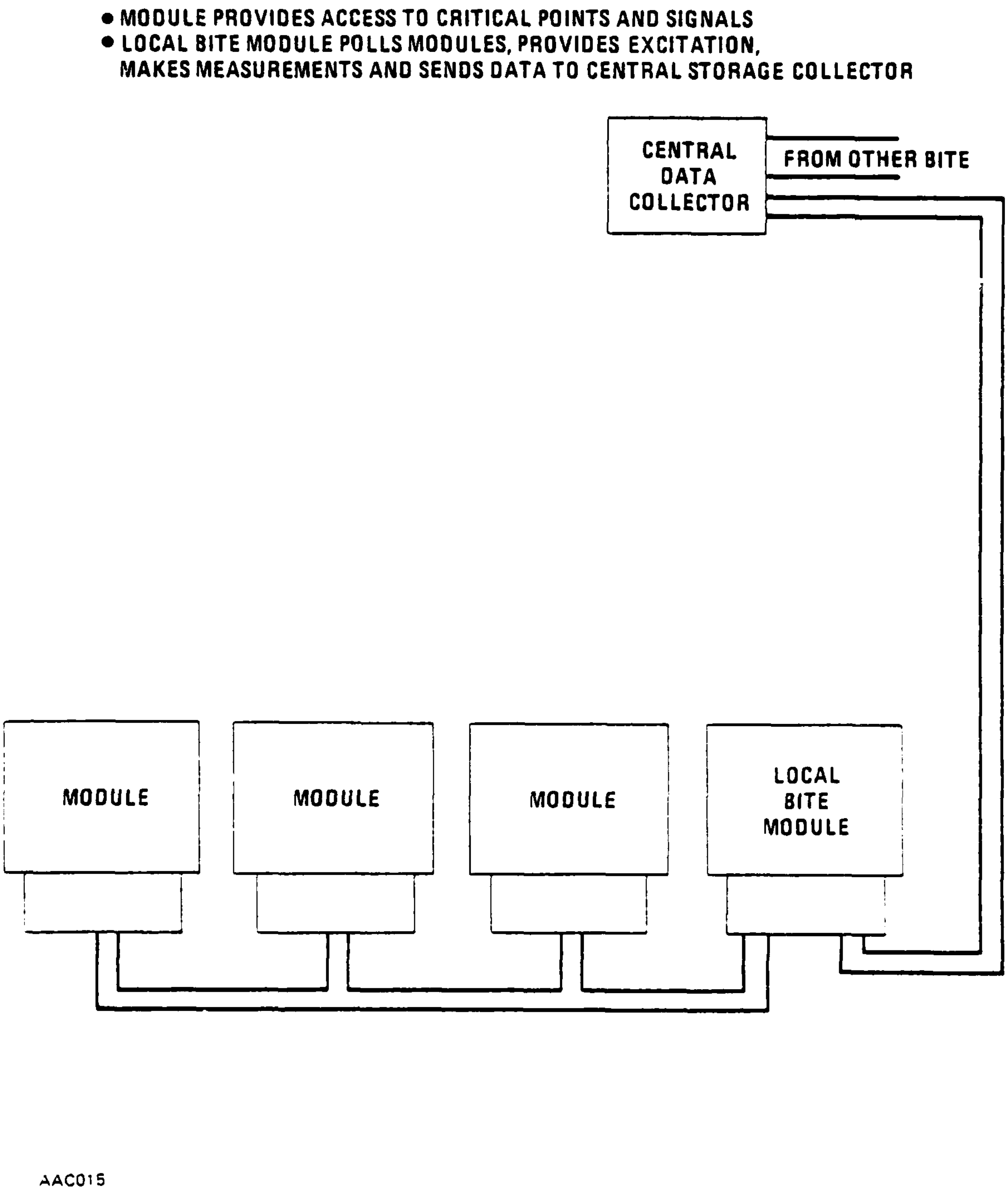


Figure 2.3.8-3. Hybrid BITE No. 1 Concept

- MODULES PERFORM EASY GO/NO GO BITE TEST
- SPECIFIC LOCAL BITE MODULES PROVIDE EXCITATION, MAKES MEASUREMENTS REPORTS RESULTS TO CENTRAL DATA COLLECTOR
- COMMAND BITE MODULE MONITORS COMMAND BUS VERIFIES PROPER DECODING AND REPORTS RESULTS

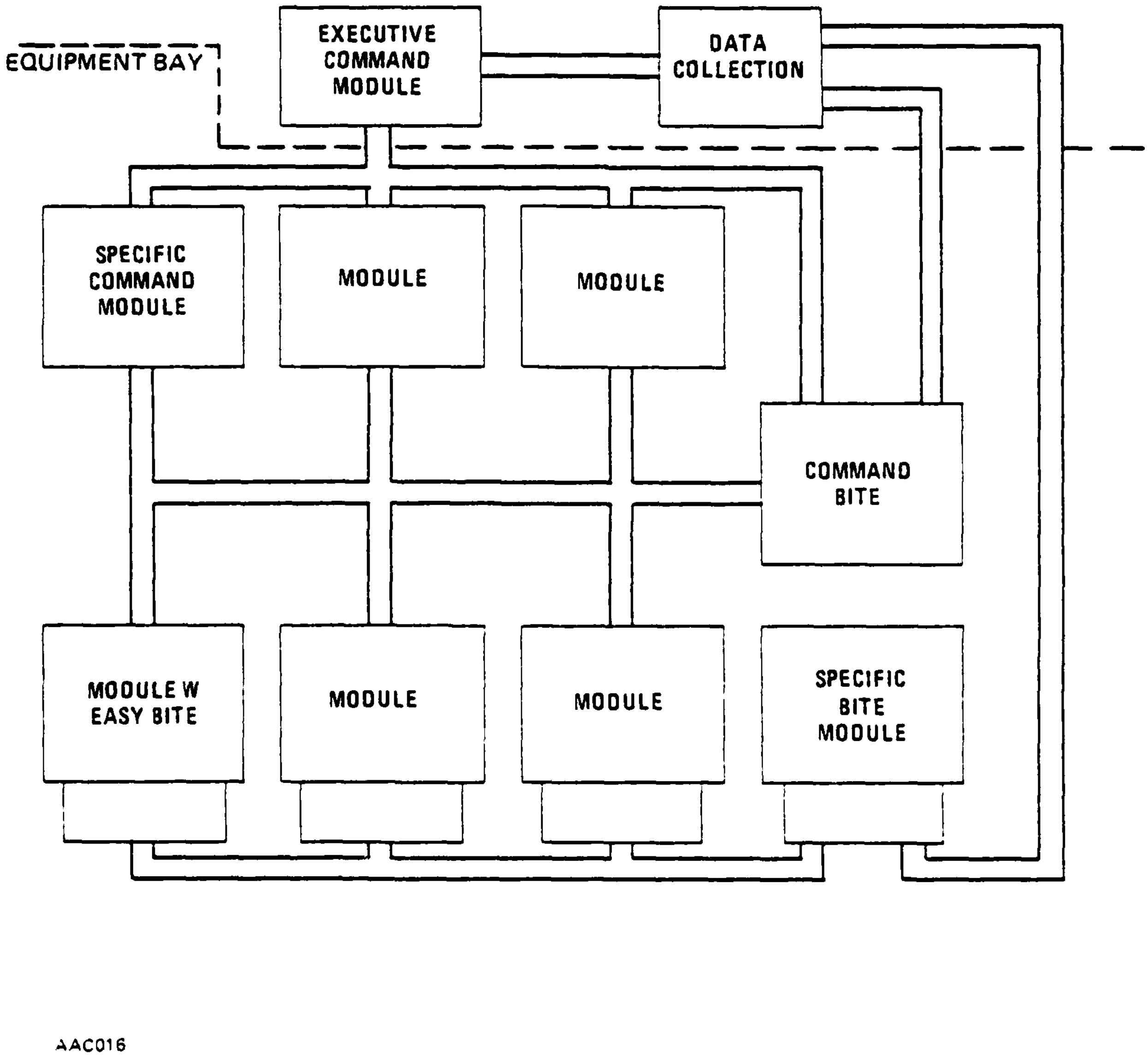


Figure 2.3.8-4. Hybrid BITE No. 3 Concept

- MODULES PERFORM EASY GO/NO GO TESTS
- SPECIFIC LOCAL BITE MODULES PROVIDE MEDIUM COMPLEXITY OF TEST TIME SHARED BETWEEN MODULES OF BAY IF REQUIRED
- LOCAL DATA/SIGNAL COLLECTION ENCODES RESULTS TO REDUCE BUSSING OUT OF BAY
- PROVIDE MAINTENANCE PERSONNEL WITH SINGLE BAY ACCESS POINT
- PROVIDES COUPLING OF SIGNALS TO CENTRAL BITE FOR DIFFICULT TESTS

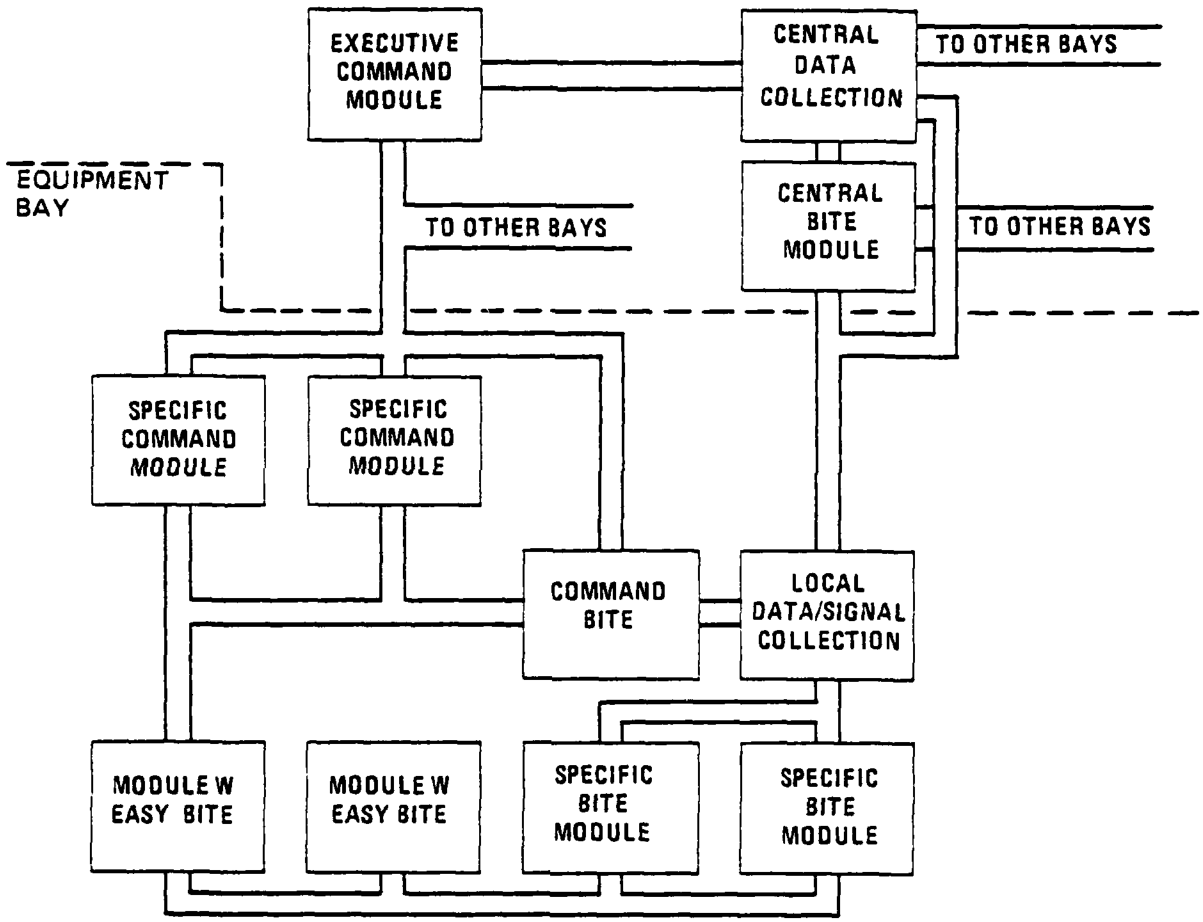


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Figure 2.3.8-5. Hybrid BITE No. 4 Concept

Table 2.3.8-1. BITE Architecture Objectives

- MAKES MAXIMUM USE OF REDUNDANT SIGNAL PROCESSING CIRCUITRY FOR SELF TEST
- ALLOWS USER NEEDS TO DETERMINE AMOUNT OF BITE
- IDENTIFIES FAULT DOWN TO MODULE LEVEL
- PROVIDES GRACEFUL DEGRADATION OF BITE AS BITE MODULES ARE LEFT OFF
- COMPLEMENTS ANY EXTERNAL TEST GEAR
- ALLOWS SHORT-TEST SEQUENCES THAT CAN BE TIME SHARED WITH NORMAL SIGNAL PROCESSING
- PROVIDES ACCESS TO CRITICAL CIRCUIT POINTS AND SIGNALS
- PROVIDES SINGLE-POINT SYSTEM ACCESS BY MAINTENANCE PERSONNEL
- TIME SHARES MEASUREMENT CIRCUITRY WHERE REDUCED COST WILL RESULT
- MINIMIZES IMPACT ON SYSTEM RELIABILITY
- MINIMIZES IMPACT ON SIGNAL PROCESSING MODULE COST
- PROVIDES BITE RESULTS CONTINUOUSLY AND MINIMIZES IMPACT ON BUSSING

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total module costs. Since these overhead functions are included in all modules and the total module count for a typical integrated system is on the order of 150 then the cost impact of these overhead functions is obvious.

From the desire to keep overhead costs down has evolved the module BITE as shown in Figure 2.3.8-6. This microprocessor based architecture employs sequential comparison of performance indicative test point voltages with stored memory. The test point set and memory module would be unique to each module type while the comparison circuits would be the same for all modules. Some test point voltages would be expected to vary as a function of the inputs to the module. To compensate for this, the mass memory has an input from the central processor which adjusts the input into the comparator depending on the external condition. Because there is no requirement for high speed or accuracy in the application, it is expected that the microprocessor would be very inexpensive in production.

Augmenting the BITE circuits in each module are two types of additional tests. One test employs simple end-to-end signal processing with a comparison of the input with the output. In this test the power amplifiers are disabled and a level controllable signal is coupled from the output of the multiband excites to the receiver input via a coupler on the antenna feedline. By measuring output S/N and distortion as a function of input level, it appears that most failures can be isolated to a single module with good probability. For those instances where isolation to a single module is difficult with simple end-to-end tests, the second type of diagnostic test is employed. These tests use

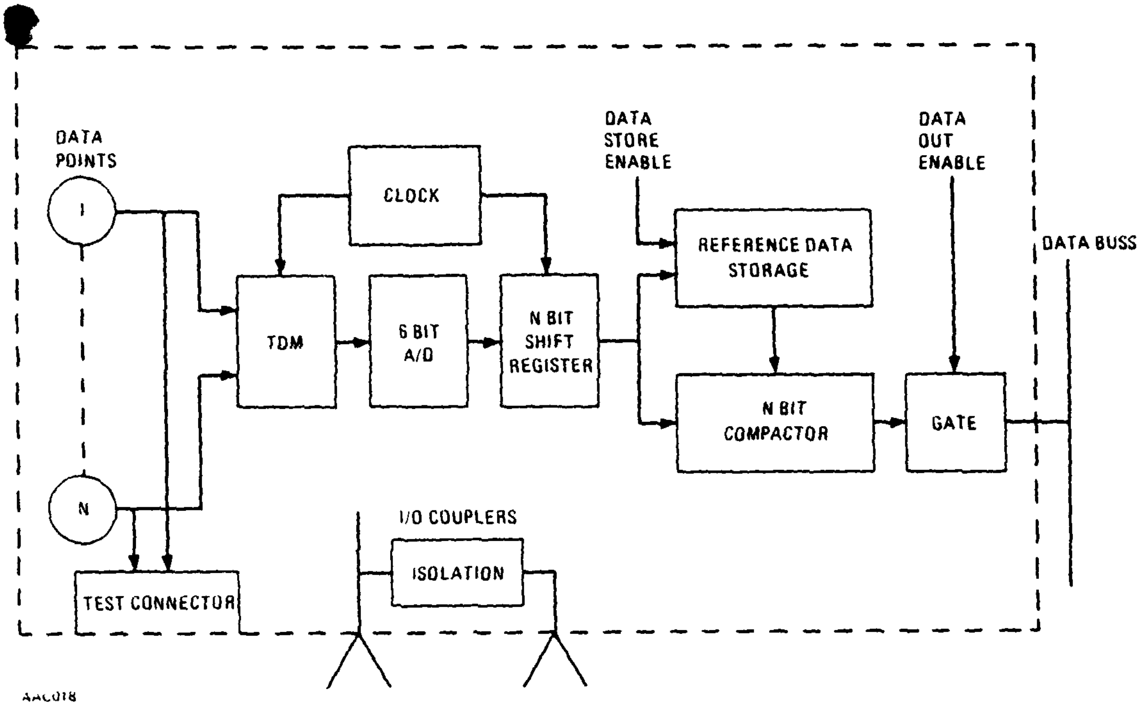


Figure 2.3.8-6. Microprocessor Based Module BITE Circuits

special purpose BITE modules to excite the module and measure its response. Time and funding limitations have not permitted an analysis of the types of these special modules desirable and it is expected that significant disagreement will be found when it comes to a list of special test modules to be procured. The key element which allows such a concept to be implemented, however, is to provide for isolated access to module input and output ports and these provisions can be included without excess costs. These I/O test points also provide a convenient means to isolate problems that are unique to the particular installation by allowing the use of very powerful laboratory test equipment without disturbing the normal signal path.

Comparison circuits would be the same for all modules. Some test point voltages would be expected to vary as a function of the inputs to the module. To compensate for this, the mass memory has an input from the central processor which adjusts the input into the computer depending on the external conditions. Because there is no requirement for high speed or accuracy in this application, it is expected that the microprocessor would be very inexpensive in production.

Augmenting the BITE circuits in each module are two types of additional tests. One test employs simple end-to-end signal processing with a comparison of the input with the output. In the test, the power amplifiers are disabled and a level controllable signal is coupled from the output of the multiband exciter to the receiver input via a coupler on the antenna feed line. By measuring output S/N and distortion as a function of input level, it appears that most failures can be isolated down to a single module with good

probability. For those instances where isolation to a single module is difficult with simple end-to-end tests the second type of diagnostic test is employed. These tests use special purpose BITE modules to excite the module and measure its response. Time and funding limitations have not permitted an analysis of the types of those special modules desirable and it is expected that significant disagreement will be found when it comes to a list of special test modules to be procured. The key element which allows such a concept to be implemented, however, is to provide for isolated access to module input and output ports and these provisions can be included without excess costs. These I/O test points also provide a convenient means to isolate problems that are unique to the particular installation by allowing the use of very powerful laboratory test equipment without disturbing the normal signal path.

2.3.9 FREQUENCY REFERENCE AND ELECTRICAL POWER DISTIRBUTION

These subsystems are supplied to all user modules on a parallel basis and because of this one important consideration in an integrated system is to protect the bus from failure within a module. Also in the case of the frequency reference the design of the bus/module interface isolation must prevent contamination of the bus with spurious signals and noise.

Because of the large numbers of bus isolation elements that will be used it is important to keep their cost to a minimum.

As far as the frequency reference subsystem is concerned it appears that a simple redundant architecture as shown in Figure 2.3.9-1 is suitable. In this configuration reference #1 is the master reference and is used to supply all modules. Selection of bus 1 is made within each module based on signal strength at the input port from bus #1. Failure of bus #1 will automatically cause switchover to bus 2. Measurement of differential phase and amplitude noise in the BITE system will allow the command system to turn off defective sources.

In the area of the system power supply it appears that almost any implementation of a standard module approach will result in significant cost savings relative to a dedicated approach. Two of the architectures receiving general support are shown in Figures 2.3.9-2a and -2b.

The architecture of Figure 2.3.9-2a employs a high voltage dc distribution bus and a family of user specified regulator modules. The impetus behind this architecture is the desirability to:

a. Employ a high voltage distribution bus to minimize I^2R losses and therefore the weight of the copper bus.

b. Employ highly efficient, high frequency PWM regulators to reduce the weight of the regulator modules.

Unfortunately this architecture has some disadvantages:

a. The high voltage dc bus is a more severe personnel hazard than an ac bus.

b. Almost all users will require some form of regulator module since the high voltage has little direct utility.

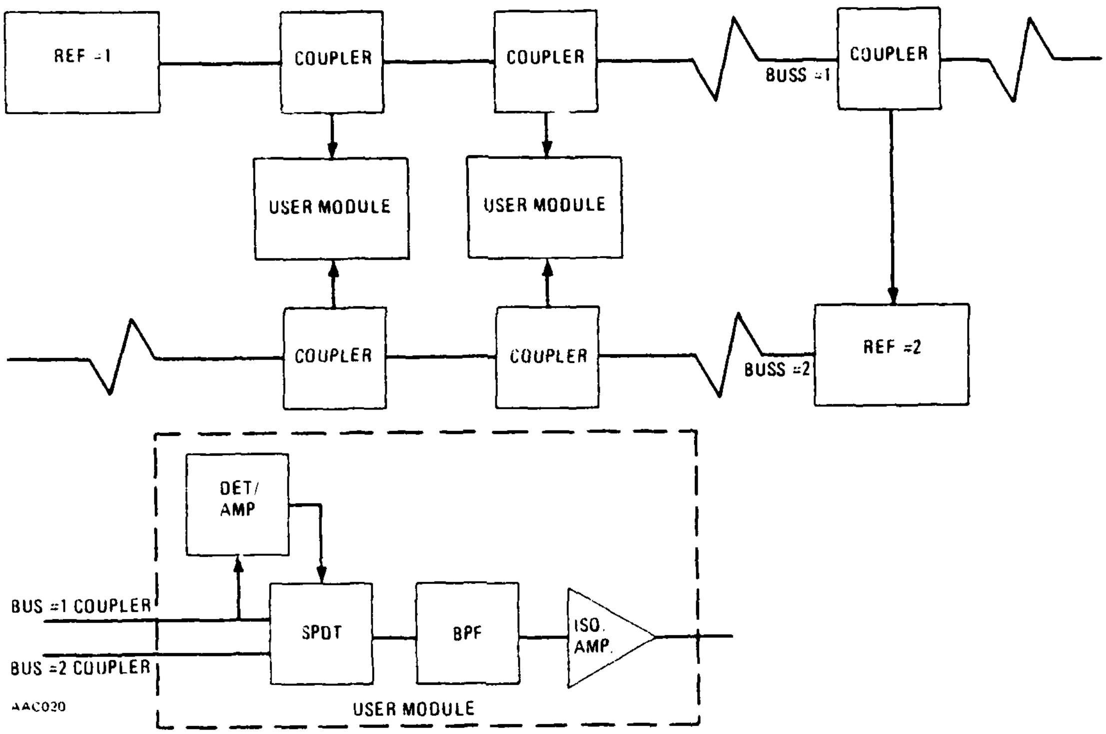


Figure 2.3.9-1. Redundant Frequency Reference Subsystem

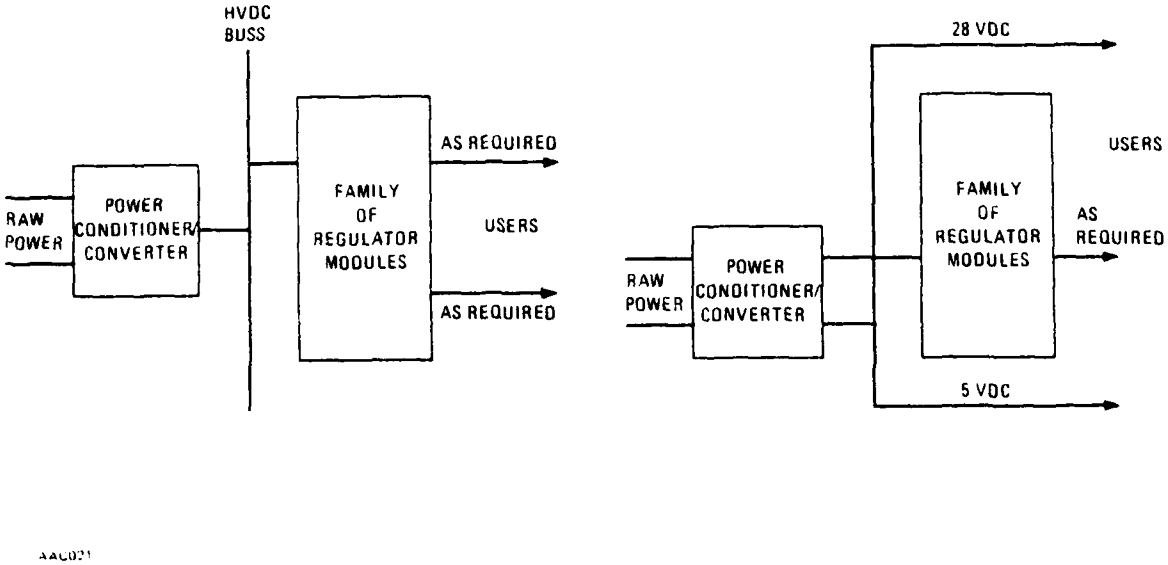


Figure 2.3.9-2. Redundant Architecture

c. Many high power users require low voltage and the conversion from very high to very low voltage is not in the optimum efficiency range.

d. The ability to control the ON/OFF condition of each module will require additional circuitry within each module or separate regulators for each module.

e. There appears to be no limit as to the number of different voltages which may be specified by the users.

The architecture of Figure 2.3.9-2b was developed in Reference 1*. It recognizes the fact that there are certain voltages which are used quite often in electronic design. In Figure 2.3.9-2b two voltages (+28V and +5V) are generated directly by the power conditioner/converter and the remainder are generated by a family of regulator modules. The architecture of 2.3.9-2b has been used as a starting point in developing a proposed power supply architecture which addresses some problems not considered in Reference 1 and which provides additional capability and flexibility. In summary the proposed system consists of:

a. A stand-alone converter which provides:

   1. a family of coarsely regulated voltages
   2. automatic adjustment according to the load on each voltage

b. A simple power adder to allow parallel converters on a bus.

c. Simple series regulator in each module which provide:

   1. a means to disconnect the module
   2. a means to protect the bus from module failure
   3. a means to meet unique regulation, ripple requirements

d. A set of standard regulator modules to meet requirements not efficiently solved by the standard family of voltages.

Tables 2.3.9-1 through 2.3.9-5 and Figures 2.3.9-3 through 2.3.9-6 provide more insight into the proposed power supply architecture.

---

*Reference 1 AFAL Technical Report, AFAL-TR-78-59, Feb 78

Table 2.3.9-1. Power Supply Architecture

Build around basic functional approach "B" concepts outlined in Technical Report AFAL-TR-78-59

Modified because

> The total power requirement is greater than the optimum range for a stand-alone power converter module and a cost-effective method of sharing the load and providing redundancy is desirable.
>
> Line drop and EMI pickup incurred in distribution of a regulated source will tend to negate the advantages of fine regulation at a central point.
>
> It is desirable to protect the power bus by current limiting in each user module and except for fuses and electromechanical devices this normally causes voltage drop.
>
> The lowest LCC will result from restricting the total number and number of different regulator modules and competitive advantage should be provided to those who use standard voltages without significant efficiency penalty.
>
> All users on a bus do not have the same regulation/ripple reguirements and a central regulator must be designed for worst case.
>
> It is desirable to allow the power system to automatically allocate its total power capability according to the demands of each bus.

Table 2.3.9-2. Identifiers Used

(most taken from AFAL-TR-78-59)

Group		
1	Module Type Identifiers	
	EI	Extended Voltage Range Integral
	NI	Narrow Voltage Range Integral
	EDPI	Extended Voltage Range Dual Polarity Integral
	SLF	Single Level Functional B
	DLF	Dual Level Functional B
	MLF	Multi Level Functional B
	EDPF	Extended Voltage Range Dual Polarity Functional B
2	Input Voltage Source	
	A	3ϕ 400 Hz AC Aircraft Power
	D	28 Vdc Aircraft Power
	28	28 Vdc from Functional B Converter
3	Output Voltage	
	05	5 to 7.5V (extended)
		5 to 55V (narrow)
	10	10 to 17V
	18	18 to 30V
	24	24 to 30V
	32	32 to 55V
	100	60 to 100V
	528	5V/28V (dual level converter)
	D5D1528	±5/±15/+28 (multiple level converter)
4	Output Power	

Table 2.3.9-3. *Modified Stand-alone Power Converter Module*

CHARACTERISTIC	REASON
Multiple output voltages (5)	Data analysis indicates that these voltages would have satisfied 60-70% of all past requirements even though no attempts to standardize voltage between equipments was made.
Non-foldback power limiting based on input current	Facilitates sharing of load by multiple modules.
Each output capable of supplying full module power	Allows power limiting at single input point and automatic compensation for variations in bus usage as the user module complement is changed. Causes slight increase in size and weight on output side of transformer.
Only coarse regulation and filtering	User module adds fine regulation and filtering to suit specific needs which allows reduced size, weight, and cost of converter module.

Table 2.3.9-4. Module Series Regulator

Inexpensive
Can be specialized to suit requirements of the module
Provides
Fine regulation
Noise and ripple rejection
Protection of the bus
Means to remotely disconnect module load from bus
Distributed regulation minimizes heat sink problem

Table 2.3.9-5. Standard Regulator Module

Function:	To provide sources which cannot be generated using simple series regulators driven from the main bus voltages or where series regulation results in an extreme efficiency penalty.		
Examples:	100V at 3 mA	source for varactor tuning	
	50V at 2A	source for transmitter power amplifier	
	10V at 6A	source for a general purpose load	
		Dissipation by series regulation from 17V supply	42W
		Dissipation by dc to dc conversion (N = 75%)	20W
		Net savings	22W

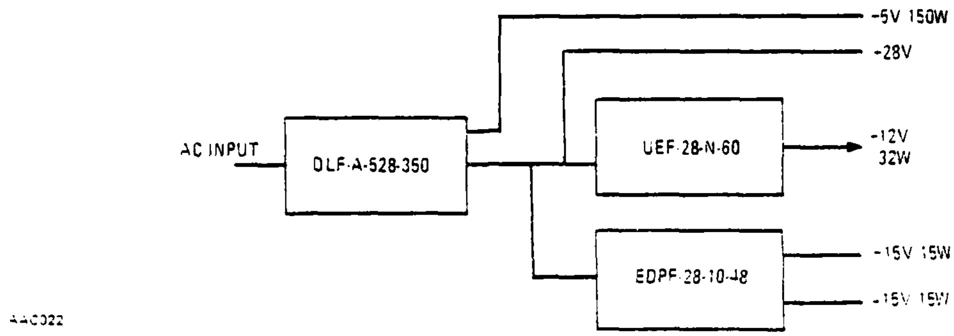


Figure 2.3.9-3. Standard Modular Power Supplies for Avionics Approach (Technical Report AFAL-TR-78-59)

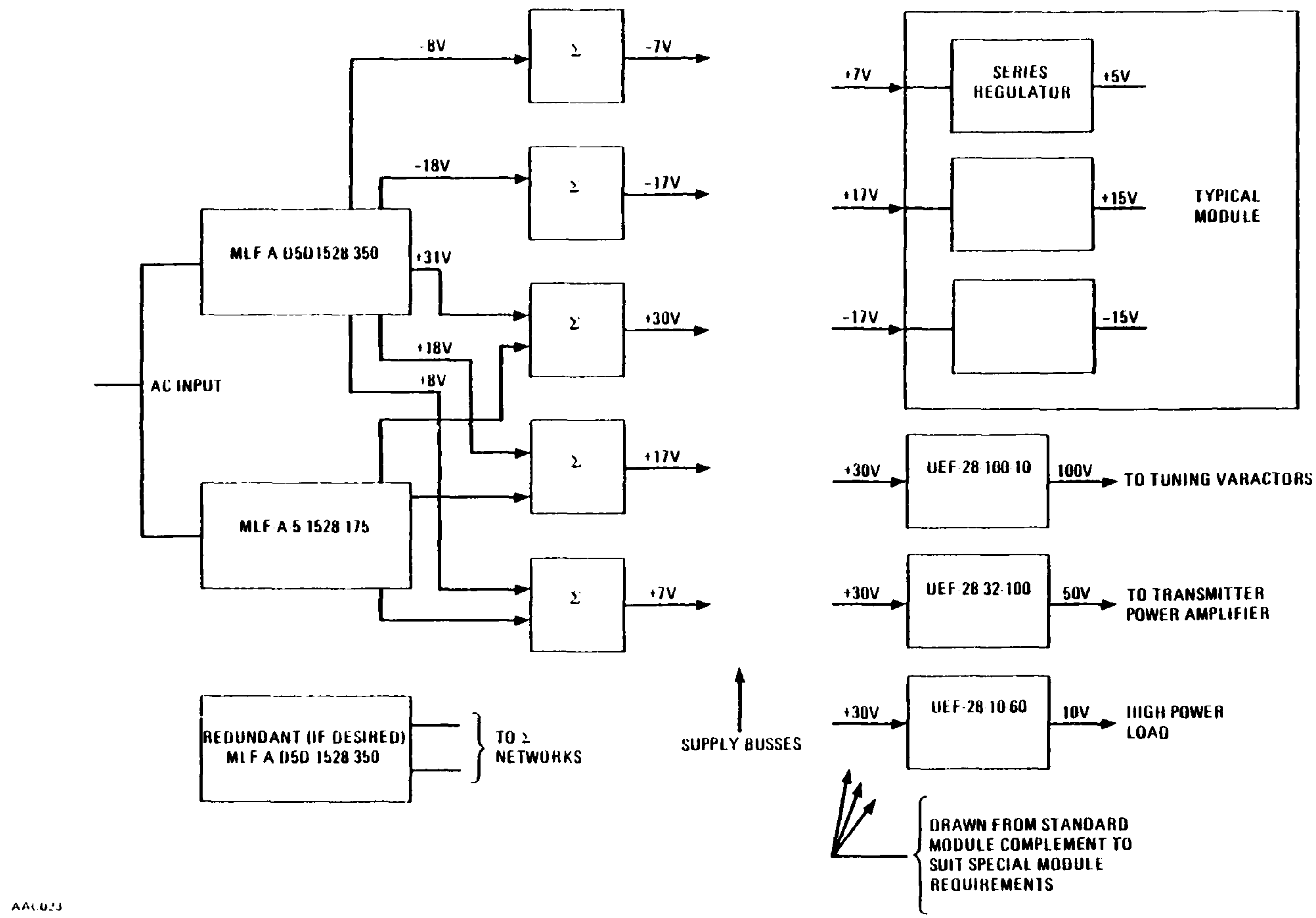


Figure 2.3.9-4. Modified Standard Modular Power Supply Avionics Approach

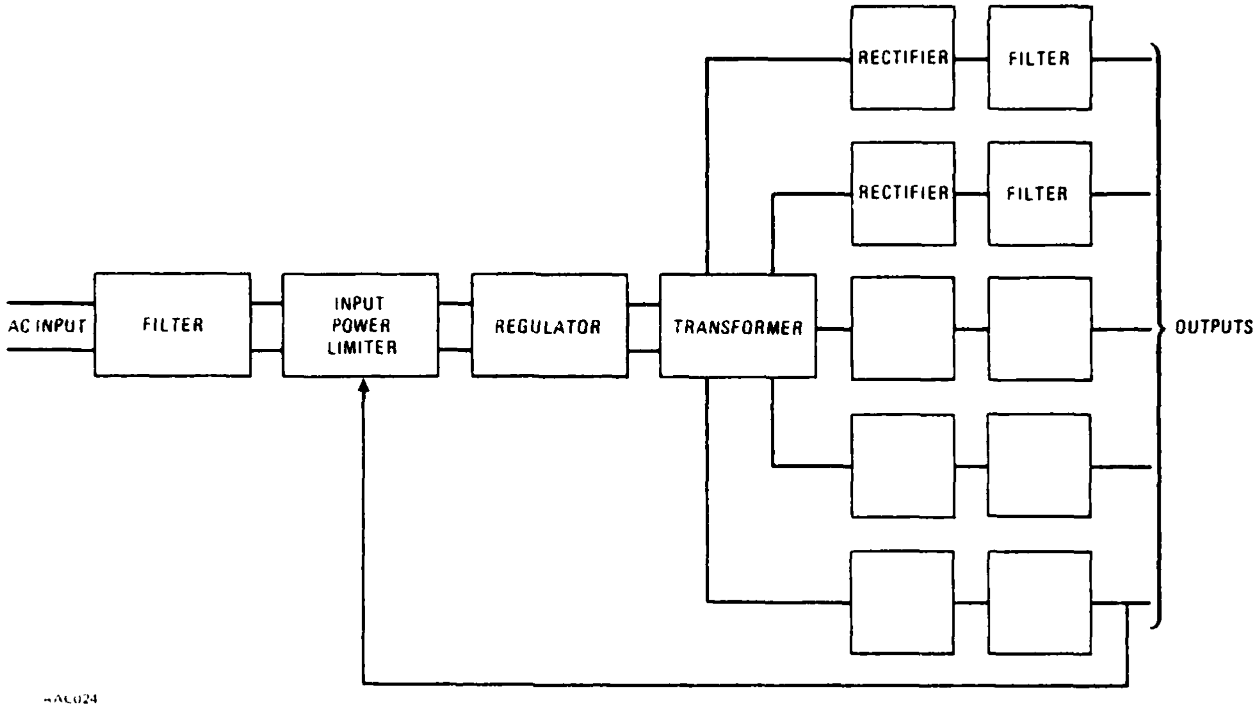
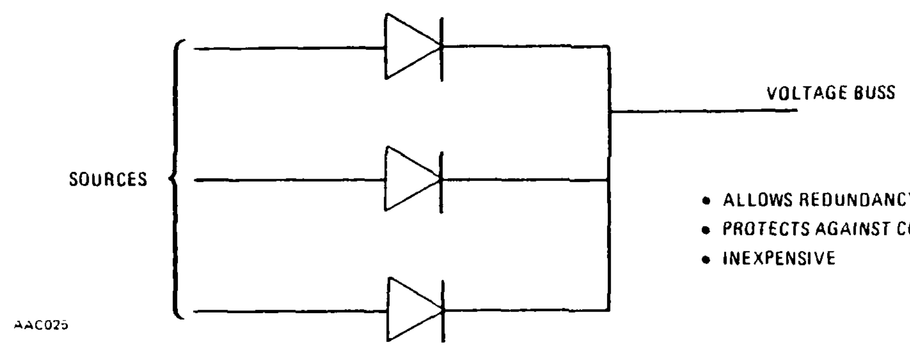


Figure 2.3.9-5. Modified Stand-alone Power Converter Module



- ALLOWS REDUNDANCY AND LOAD SHARING
- PROTECTS AGAINST CONVERTER FAILURE
- INEXPENSIVE

Figure 2.3.9-6. Power Σ

2.4 ARCHITECTURE SYNTHESIS

The major objective of the MFBARS study is to develop a wide range of CNI architectures and compare them with a baseline CNI architecture that could exist in the same time frame but with each CNI function (HF, VHF AM, VHF FM, UHF, etc.) as an independently developed black box. two non-integrated baseline architectures were established. The first, MFBARS Architecture No. 1, has a separate unit for each function and is described in Section 2.4.1. The second, MFBARS Architecture No. 2 is the same as Architecture No. 1 except that the JTIDS, TACAN and IFF functions are integrated together into one black box. Current development programs are considering this degree of integration. Architecture No. 2 is described in Section 2.4.2.

A third non-integrated architecture, No. 7, uses common modules across the discrete LRUs. It is described in Section 2.4.7.

Five integrated MFBARS architectures were defined, Architecture No. 3 through Architecture No. 7. These architectures are described in Sections 2.4.3 through 2.4.7.

Approximately 20 different architectural variations were considered during the investigation. Many could be discarded as being obviously more costly than the baseline, others had an unacceptable performance or were vulnerable to single point failures. All architectures that were selected for economic analysis contain four major subsystems: the antenna subsystem, the RF/IF subsystem, the signal distribution subsystem and the signal processing subsystem. We considered integrating the wideband and narrowband signal processors with the IF modules. One of the selected architectures, No. 5, has the wideband signal processor integrated with the associated IF resources. We determined that it would not be cost-effective to integrate a narrowband signal processor with each IF strip. The increased number of processors required would more than offset the saving resulting from eliminating the corresponding on-bus and off-bus couplers for an FDM bus approach. For the digital signal distribution bus used in Architecture No. 4 the cost increase would be even larger. One contributing factor to the comparatively low cost of distributing the narrowband signals, in the architectures that were selected for economic analysis, results from combining the signals through time division multiplexing (TDM) before transmitting the information over the bus. Particularly for the FDM bus approach used in Architectures 3, 5 and 6 the saving is considerable since the cost of multiplexers and demultiplexers are much less than the cost of FDM onbus and offbus couplers. The question of whether or not to integrate the wideband processor with the associated IF modules is not merely an economic consideration. The use of the signal distribution bus enhances the level of self-test and self-diagnosis possible and also allows more flexibility in distributing the wideband resources between the available equipment locations in the aircraft. In order to provide maximum flexibility and future growth capability all integrated architectures investigated (except wideband signals for Architecture 5) use signal distribution buses. It follows that the cost of the signal processing subsystem is relatively constant for the selected architectures.

The major cost drivers for the selected integrated architectures are the RF/IF and the antenna subsystems. The rapid improvement in cost and performance that characterizes digital LSI circuits is not matched in RF circuitry and antennas and the trend is therefore to shift an increasingly larger fraction of the life cycle cost to these subsystems. All the

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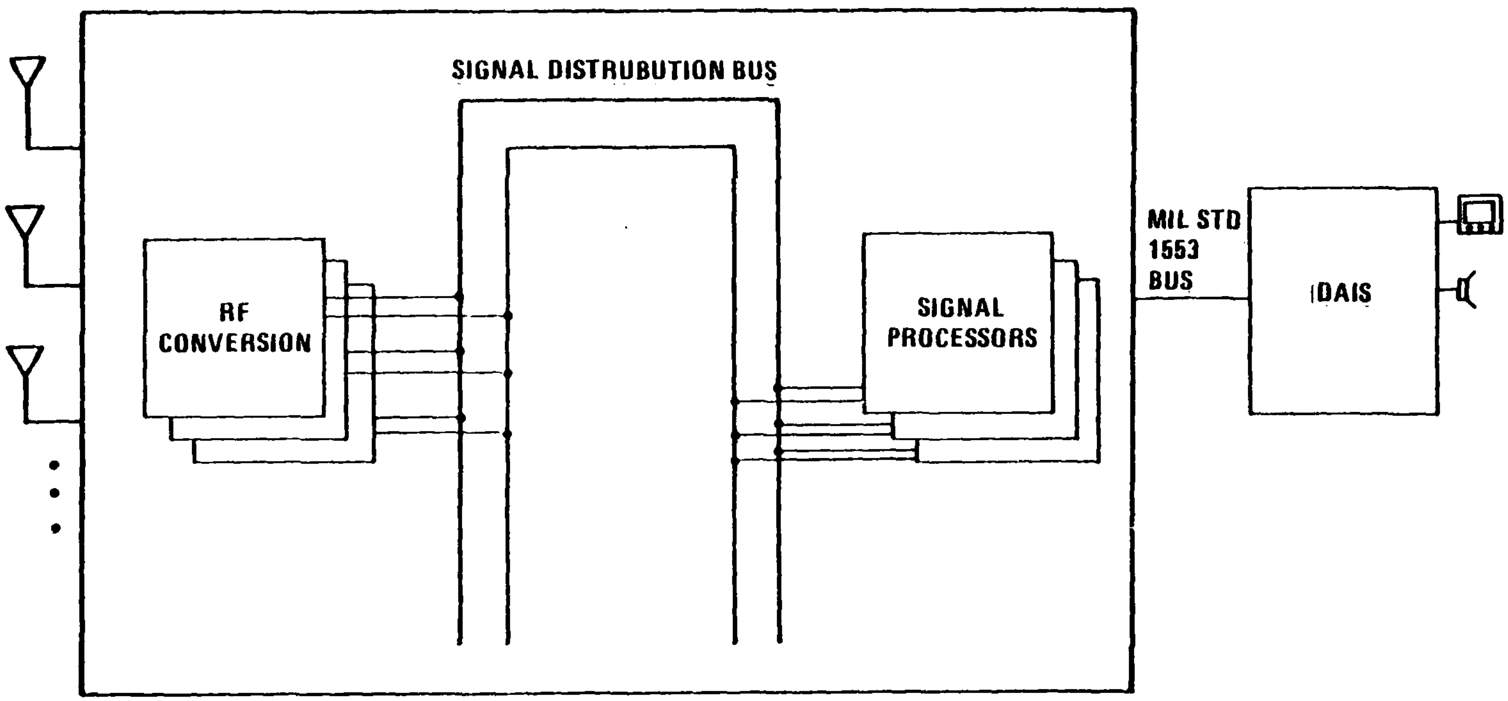


SIGNAL DISTRUBUTION BUS
RF CONVERSION
SIGNAL PROCESSORS
MIL STD 1553 BUS
IDAIS

integrated architectures have been selected to exemplify different approaches in this area. However a maximum of standard modules and dual conversion with a 70 MHz standard second IF frequency is used for all cases. Architecture 4 explores the merits of colocating preamplifiers/power amplifiers with the antennas and utilizing a common RF bus for signal distribution to receivers/transmitters. Architecture No. 6 represents an attempt to optimize the antenna/RF interface. Architecture No. 5 takes a hierarchical approach to the distribution of control, partitioning and all other subelements of architecture.

Table 2.4-1 is a summary of the key features of the architectures. Detailed descriptions and block diagrams of each architecture analyzed for economic merits are given in the following subsections.

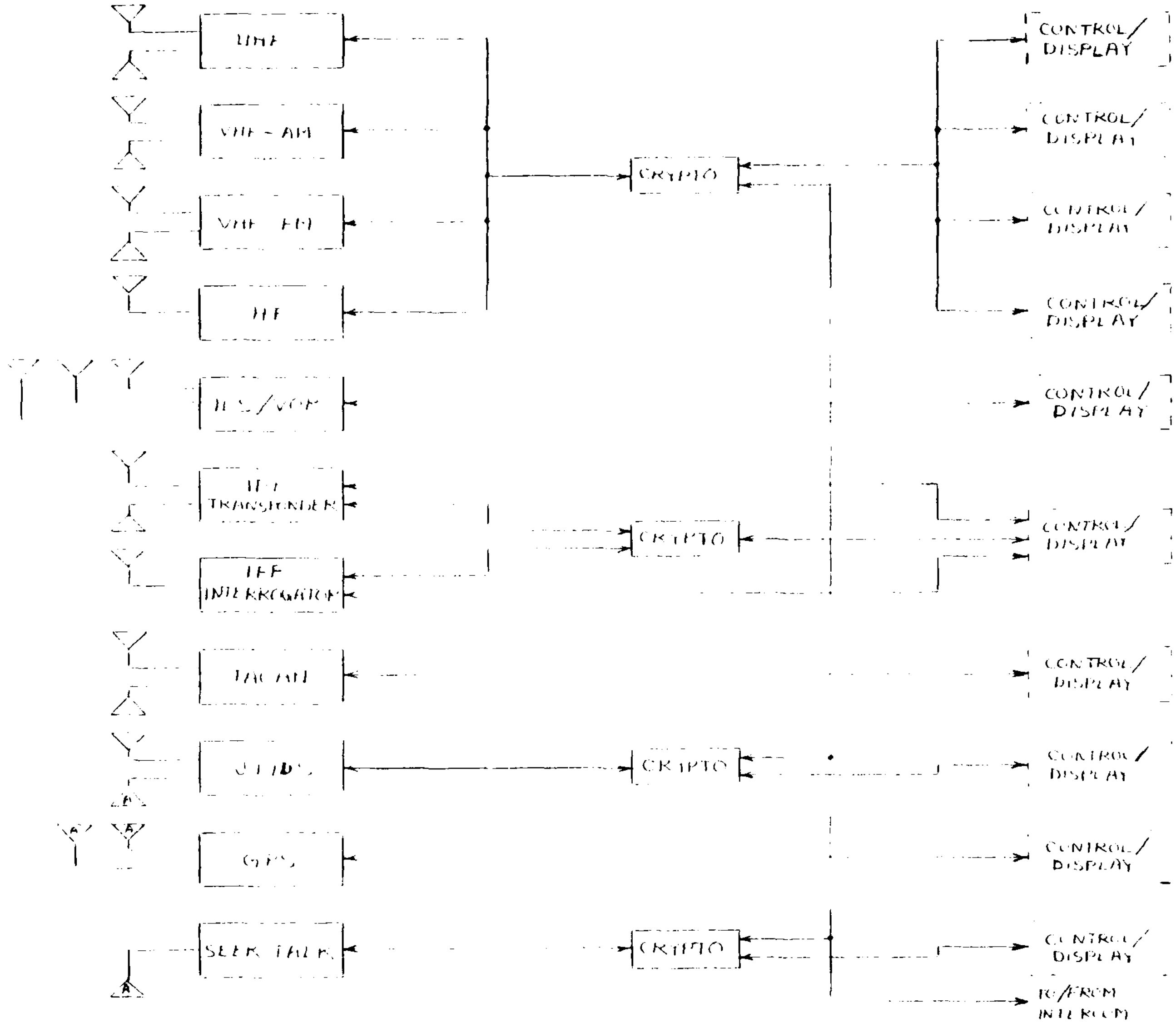
2.4.1 MFBARS ARCHITECTURE NO. 1

This architecture assumes no integration of the CNI functions. The architecture was derived from a list of equipment taken from the AFAL letter dated 15 May 1978. The list is shown in Section 2.1, Table 2.1-2. MFBARS Architecture No. 1 assumes a next generation of separate equipment development using 1985 technology. The performance and capability of MFBARS Architecture No. 1 is assumed to be equivalent to that of the list of equipment shown in Table 2.1-2.

2.4.1.1 BASELINE DESCRIPTION – MFBARS Architecture No. 1 consists of antennas, receivers and/or transmitter units and crypto units. Display and control devices are not included in order to make the non-integrated and integrated architectures more comparable when assessing the advantages of the integrated architectures when compared with the non-integrated baseline.

Table 2.4-1. Key Architectural Features

ARCHITECTURE NO.	KEY FEATURES
1	Discrete
2	JTIDS, TACAN, IFF integrated
3	Integrated, uses FDM signal distribution bus.
4	Integrated, uses RF bus and digital signal distribution bus.
5	Hierarchical version of 3.
6	Optimized RF/antenna configuration
7	Discrete with common modules.



MFBARS Architecture No. 1

2.4.1.2 EQUIPMENT LIST – A list of the equipment for Architecture No. 1 is shown in Table 2.4.1.2-1. The antennas used are the same as described for Architecture No. 3 in Section 2.4.3.1.

2.4.1.3 PHYSICAL CHARACTERISTICS – The size and weight of each equipment unit in Architecture No. 1 are shown in Table 2.4.1.2-1.

2.4.1.4 ELECTRICAL POWER REQUIREMENTS – The electrical power requirements for Architecture No. 1 are shown for each equipment unit in Table 2.4.1.2-1.

2.4.1.5 SOFTWARE – Architecture No. 1 was assumed to require the same software development for JTIDS, GPS and SEEK TALK as the integrated architectures. This software is described in Table 2.4.1.5-1.

2.4.1.6 PERFORMANCE CHARACTERISTICS – The performance characteristics of Architecture No. 1 is equivalent to that of the list of equipment shown in Table II of Section 2.1. A summary of the performance of this equipment is shown in Table 2.4.1.6-1.

2.4.1.7 LOGISTIC SUPPORT – The assumptions used to determine the logistics support costs for Architecture No. 1 are discussed in Section 4.

Table 2.4.1.2-1. Architecture No. 1 Dedicated Equipment with 1985 Technology

SYSTEM FUNCTION	1978 EQUIVALENT	SIZE (CU IN)	WEIGHT (LBS)	POWER (WATTS)
GPS	GPS X set	2000	50	150
JTIDS	JTIDS CLASS II single function	2400	150	350
IFF Transponder	APX-101	270	12	40
IFF Interrogator	APX-81	450	22	120
TACAN	ARN-118	210	11	40
SEEK TALK	TBD	900	27	30
UHF-AM R/T	ARC-164 plus one extra receiver	240	6	18
VHF-AM R/T	ARC-115 with expanded frequency and two extra receivers	270	7	18
VHF-FM R/T	ARC 131 with expanded frequency	180	5	10
HF R/T	ARC-154	400	12	80
ILS/VOR	ANR-108	180	5	8
IFF Crypto	KIT-1A	32	3	2
Comm Crypto	KY-28	80	5	3

Table 2.4.1.5-1. MFBARS Architecture No. 1 Software

FUNCTION	TOTAL MEMORY AVAILABLE	TOTAL MEMORY REQUIRED	MEMORY FOR INSTRUCTIONS
GPS Signal Processing	48K	30K (16 bit)	20K
SEEK TALK	24K	15K (16 bit)	10K
Adaptive Antenna	12K	8K (8 bit)	4K
GPS Position Computations			21K
JTIDS Relative Navigation			21.6K
Executives			10K

Table 2.4.1.6-1. Architecture No. 1 Performance Characteristics

SYSTEM FUNCTION	PERFORMANCE HIGHLIGHTS
GPS	Receive only, 2 frequency, 5 simultaneous signals, 5 element adaptive array
JTIDS	51 channels, 960-1215 MHz, spread spectrum, 0.2/0.8 Kw Pk power, 5 element adaptive array, 8 signals during acquisition
IFF Transponder	0.5 Kw Pk, 1% duty, Modes 1, 2, 3A, C, 4 with I/P and EMERGENCY 1030 receive, 1090 transmit
IFF Interrogator	1.0/2.5 Kw Pk, 1% duty, Modes 1, 2, 3A, C, 4, 1090 receiver, 1030 transmit
TACAN	1025-1150 transmit, 962-1213 receive, 0.5-2.0 Kw with controlled rise and fall times
SEEK TALK	UHF Spread Spectrum, 5 element adaptive array
UHF-AM R/T	10 watts, 225-400 MHz, 7000 channels, 4 uv sensitivity, narrow/wide audio Bw, 3 simultaneous receive channels (one guard)
VHF-AM R/T	10 watts, 108-174 MHz, 25 KHz channel spacing, 4 simultaneous receive channels (2 guard), 3 uv sensitivity
VHF-FM R/T	10 watts 30-88 MHz, 50 KHz channel spacing, 2 simultaneous receive signals (1 guard)
HF/R/T	400 watts PEP, 2-30 MHz, 1 KHz channel spacing, 2 simultaneous receive signals (1 guard) 1 uv sensitivity
ILS/VOR	Receive only 108.1-111.95 localizer, 20X, 20Y channels, 329.15-335.0 glideslope 40 channels 75 MHz marker beacon
IFF Crypto	
Comm Crypto	

2.4.1.8 ECONOMIC ANALYSIS – Table 2.4.1.8-1 shows the breakdown of the LCC for Architecture No. 1.

Table 2.4.1.8-1. LCC Breakdown

SYSTEM	COST
Antennas	$ 13.8
GPS	41.0
JTIDS	68.5
IFF Transponder	5.5
IFF Interrogator	12.5
TACAN	6.0
SEEK TALK	23.5
UHF-AM R/T	3.5
VHF-AM R/T	4.4
VHF-FM R/T	3.5
HF R/T	6.2
ILS/VOR	3.1
IFF Crypto	2.0
COMM Crypto	2.4
Hardware Total	195.9
Software Total	6.3
Logistics Total	87.0
LCC Total	$289.2K per system

The cost of this architecture is used as a baseline for comparing all other architecture costs. Table 2.4.1.8-2 is the PRICE printout for Architecture 1. The 20K per set difference is due to the fact that the PRICE printout does not include software or antenna costs. It will also be noted that GDE defines support costs as including support equipment and initial spares. Thus our support costs are significantly larger than those shown in the PRICE printout.

Table 2.4.1.8-2. Price Life Cycle Cost for Architecture No. 1

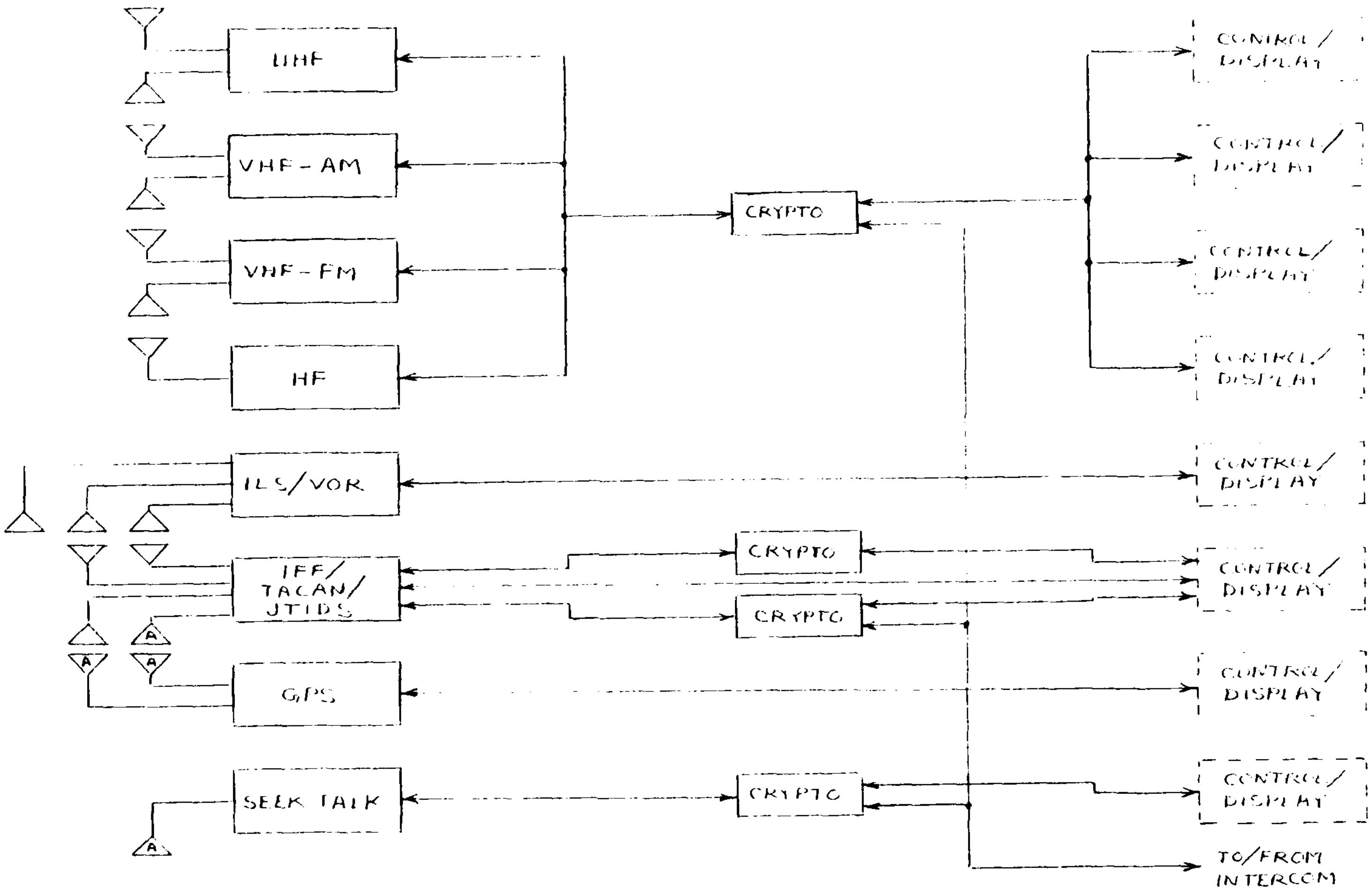
SYSTEM TOTALS PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
Equipment	64006.	117421.	0.	181427.
Support Equip.	0.	26374.	26374.	52749.
Manpower	0.	0.	7012.	7012.
Supply	0.	14689.	9978.	24667.
Supply Adm.	0.	112.	1123.	1235.
Contractor Support	0.	0.	0.	0.
Other	0.	0.	1322.	1322.
Total Cost	64006.	158596.	45810.	268412.
Additional Cost	0.	0.	0.	0.
Grand Total	64006.	158596.	45810.	268412.
System Series MTBF	49.			
	$1000	%		
Equip. Dev.	64006	24		
Equip. Prod.	117421	44		
Support Total	86985	32		
	268412			

2.4.2 MFBARS ARCHITECTURE NO. 2

This architecture is the same as Architecture No. 1 except a small degree of integration of functions consistent with current funded development programs. This integration consists of combining the JTIDS, IFF, and TACAN functions into one unit.

2.4.2.1 BASELINE DESCRIPTION – MFBARS Architecture No. 2 consists of antennas, receivers and/or transmitter units and crypto units. Display and control devices are not included in order to make this essentially non-integrated architecture more comparable when assessing the advantages when compared with the integrated architectures.

2.4.2.2 EQUIPMENT LIST – A list of the equipment for Architecture No. 2 is shown in Table 2.4.2.2-1.



MFBARS Architecture No. 2

Table 2.4.2.2-1. Architecture 2 Dedicated Equipment 1985 Projection

	1978 EQUIVALENT	SIZE (CU IN)	WEIGHT (LBS)	POWER (WATTS)
GPS	GPS X Set	2000	50	150
L-Band (JTIDS, IFF, TACAN)	TBD	3300	160	450
SEEK TALK	TBD	900	27	30
UHF-AM R/T	ARC-164 plus one extra receiver	240	6	18
VHF-AM R/T	ARC-115 with expanded frequency and two extra receivers	270	7	18
VHF-FM R/T	ARC-131 with expanded frequency	180	5	10
HF R/T	ARC-154	400	12	80
ILS/VOR	ARN-108	180	5	8
IFF crypto				
COMM crypto				

2.4.2.3 PHYSICAL CHARACTERISTICS – The size and weight of each equipment unit in Architecture No. 2 are shown in Table 2.4.2.2-1.

2.4.2.4 ELECTRICAL POWER REQUIREMENTS – The electrical power requirements for Architecture No. 2 are shown for each equipment unit in Table 2.4.2.2-1.

2.4.2.5 SOFTWARE – Architecture No. 2 was assumed to require the same software development for JTIDS, GPS, and SEEK TALK as the integrated architectures. This software is described in Table 2.4.1.5-1.

2.4.2.6 PERFORMANCE CHARACTERISTICS – The performance characteristics of Architecture No. 2 is equivalent to that of the list of equipment shown in Table 2.1-1 of Section 2.1. A summary of the performance of this equipment is shown in Table 2.4.2.6-1.

2.4.2.7 LOGISTIC SUPPORT – The assumptions used to determine the logistic support costs for Architecture No. 2 are discussed in Section 4.

2.4.2.8 ECONOMIC ANALYSIS – Table 2.4.2.8-1 shows the breakdown of the LCC for Architecture No. 2.

This architecture represents a significant 12% decrease in total LCC relativity to the baseline of Architecture No. 1. All of this saving is due to combining the JTIDS, IFF and TACAN functions into a common L-Band equipment.

2.4.3 MFBARS ARCHITECTURE NO. 3

Architecture No. 3 is the first totally integrated MFBARS configuration. This architecture is intended to have the equivalent functions, capability and performance of Architecture No. 1 and No. 2. Table 2.4.3-1 lists the functions to be performed by Architecture No. 3.

This architecture consists of antennas, receivers, transmitters, signal distribution buses, signal processors, a system controller, and data/control buses as shown in Figure 2.4.3-1. The antennas for the conventional communication functions (HF, VHF, UHF) are types in current use and are dedicated to each function. GPS uses two null steering adaptive array antennas; one for frequency L1 and one for L2. Both are to be located on the top of the aircraft and are receive only antennas.

SEEK TALK has a null-steering adaptive antenna located on the bottom of the fuselage. The array is used for receives. One of the elements is used for transmit. JTIDS has a single element antenna on the top of the aircraft and a null-steering array on the bottom. Either the top or bottom antennas can be used for transmit or receive with only one element of the array used for transmit.

Each communication function has dedicated preamplifiers and power amplifiers. The conventional communications share three multiband receivers and one multiband exciter to allow simultaneous reception on any three channels and transmission in any of the bands.

Table 2.4.2.6-1. Architecture No. 2 Performance Characteristics

SYSTEM FUNCTION	PERFORMANCE HIGHLIGHTS	
GPS	Receive only, 2 frequency, 5 simultaneous signals, 5 element adaptive array	
	51 channels, 960-1215 MHz, spread spectrum, 0.2/0.8 KW peak power, 5 element adaptive array, 8 signals during acquisition;	
L-Band	0.5 KW peak, 1% duty, Modes 1, 2, 3A, C, 4 with I/P and emergency 1030 receive, 1090 transmit;	Time Shared-Transmit
	1.0/2.5 KW peak, 1% duty, Modes 1, 2, 3A, C, 4, 1090 Receive, 1030 transmit;	
	1025-1150 transmit, 962-1213 receive, 0.5-2.0 KW with controlled rise and fall times	
SEEK TALK	UHF Spread Spectrum, 5 element adaptive array	
UHF-AM R/T	10 watts, 225-400 MHz, 7,000 channels, 4 MV sensitivity, narrow/wide audio BW, 3 simultaneous receive channels (one guard)	
VHF-AM R/T	10 watts, 108-174 MHz, 25 kHz channel spacing, 4 simultaneous receive channels (two guard), 3 MV sensitivity	
VHF-FM R/T	10 watts, 30-88 MHz, 50 kHz channel spacing, 2 simultaneous receive signals (one guard)	
HF R/T	400 watts PEP, 2-30 MHz, 1 kHz channel spacing, 2 simultaneous receive signals (one guard), 1 MV sensitivity	
ILS/VOR	Receive only, 108.1-111.95 localizer, 20X, 20Y channels, 329.15-335.0 Glideslope, 40 channels, 75 MHz marker beacon	
IFF Crypto		
COMM Crypto		

Table 2.4.2.8-1. LCC Breakdown

SYSTEM	COST
Antenna	13.8
GPS	41.0
L-Band	74.3
SEEK TALK	23.5
UHF-AM R/T	3.5
VHF-AM R/T	4.4
VHF-FM R/T	3.5
HF R/T	6.2
ILS	3.1
IFF Crypto	2.0
COMM Crypto	2.4
Hardware Total	177.7
Software Total	6.3
Logistics Total	73.0
LCC Total	$257.0K per system

Separate frequency division multiplex signal distribution buses are used to interconnect the multiband receivers and exciters with the signal processors at the IF of .70 MHz. The innovative combination of time division multiplex TDM and frequency division multiplex (FDM) described in Section 2.3.5 is used to minimize the number of FDM channels.

The narrowband processors handle the modulation and demodulation of GPS and conventional communication signals. The wideband processor decodes and encodes the JTIDS, TACAN, and IFF signals.

The system controller provides overall control and monitoring of all parts of the MFBARS system as commanded via the DAIS system in the aircraft and provides information to be displayed to the pilot via DAIS. The system controller also provides data processing capability to handle the GPS, SEEK TALK, and JTIDS navigation functions.

The configuration is subdivided into functionally separate modules with built-in-test data/control bus interface microprocessor control and electrical power conditioning.

Table 2.4.3-1. MFBARS Integrated Architecture Functions

1. Position (3D) and velocity determination from whatever "beacon" environment available (Precision: GPS "x")
   - (i) Absolute
   - (ii) Relative
   - (iii) Downgraded to reflect availability of external signals to precision available from external system (e.g., R Nav)
2. Automatic responses to external interrogations (962-1215 MHz)
   - (i) Identification in MK XII modes 1-4 (1090 T, 1030 R)
   - (ii) A/A TACAN interrogation
   - (iii) RTT requests
   - (iv) "Technical" acknowledgement to all msg. requiring pilot response
3. Receive selected signals in accordance with appropriate format, modulation, and net protocol as follows:
   - a. (i) JTIDS (IJMS) in TDMA format (implies 8 simultaneous frequency channels)
     - (ii) *JTIDS signals in DTDMA format* up to maximum constraint of 8 channels for (i)
     - (iii) TACAN ground beacon responses to (a/c interrogation)
     - (iv) All MK XII interrogations
     - (v) AJ voice and command voice transmissions
   - b. Performance requirements shall meet the equivalent rates, thresholds, error, etc. values of the parent single function hardware.

     Exception: If timesharing of resources between systems is used, a 10% increase in system function "countdown" (countdown, msg, loss rate, etc.) may be considered equivalent.
   - c. With the exception in b., the performance shall be required to be functionally the same as that achieved by having independent JTIDS, TACAN, MK XII and SEEK TALK hardware simultaneously in the switch-on/active mode.
4. Receive selected signals in "conventional" modes (signal BW constrained to 25 kHz) in the 2-400 MHz portion of spectrum; as follows:
   - a. (i) On "guard" channels, one in each of the 2-30, 30-88, 108-156, 156-174, 225-400 band allocations.

Table 2.4.3-1. MFBARS Integrated Architecture Functions (Continued)

(ii) On designated operating channels: 2 in the 225-400 MHz band, one in each of the other bands.

b. Performance requirements for each channel, individually, are those of the individual terminals constituting the base line. Any degradation arising from integration should not significantly degrade aircraft mission performance.

c. Simultaneous voice outputs from at least three selectable channels is required, with at least one guard channel included. Selection may be manual, or may be automatically selected from parameter indicating channel activity.

5. Transmission of required signals in the JTIDS, TACAN, IFF, and AJ voice formats as required. See note 3(b), 3(c).

6. Transmission on at least one channel corresponding to the receive capability in (4).

7. The ability to select, and/or preprogram channels and information transfer functions as required in the systems identified in (1)-(4).

Additional Functions –

8. The ability to sense conditions of link degradation (jamming and module failure).

9. The ability to automatically reprogram and/or provide actions for pilot reprogramming of module configurations to meet the conditions of the mission segment.

10. Flexibility to add preprogram and select algorithms to provide functions of DABS and derivative, MK XII improved, SINCGARS, PLRS, PELS DME link, radar altimeter. Direction finding, relaying.

These modules have simple interfaces, can be replaced on the flight line like LRUs; many can be thrown away rather than repaired and form, fit, and function specifications can be written to allow multiple source procurement of the modules.

2.4.3.1 ANTENNA CONFIGURATION – A number of antennas to be included in MFBARS architecture design are in varous stages of design or advanced development by several antenna houses. In some cases as many as four contractors are developing antennas for the same application.

We have talked to several antenna houses and also used in-house experience to estimate the types of antennas and their availability and sizes for use with MFBARS architecture design. It appears that within 3 to 4 years suitable antennas can be designed into new aircraft or else will be available as tailcap or microstrip patch antennas. Table 2.4.3.1-1 shows the compilation of what can reasonably be expected.

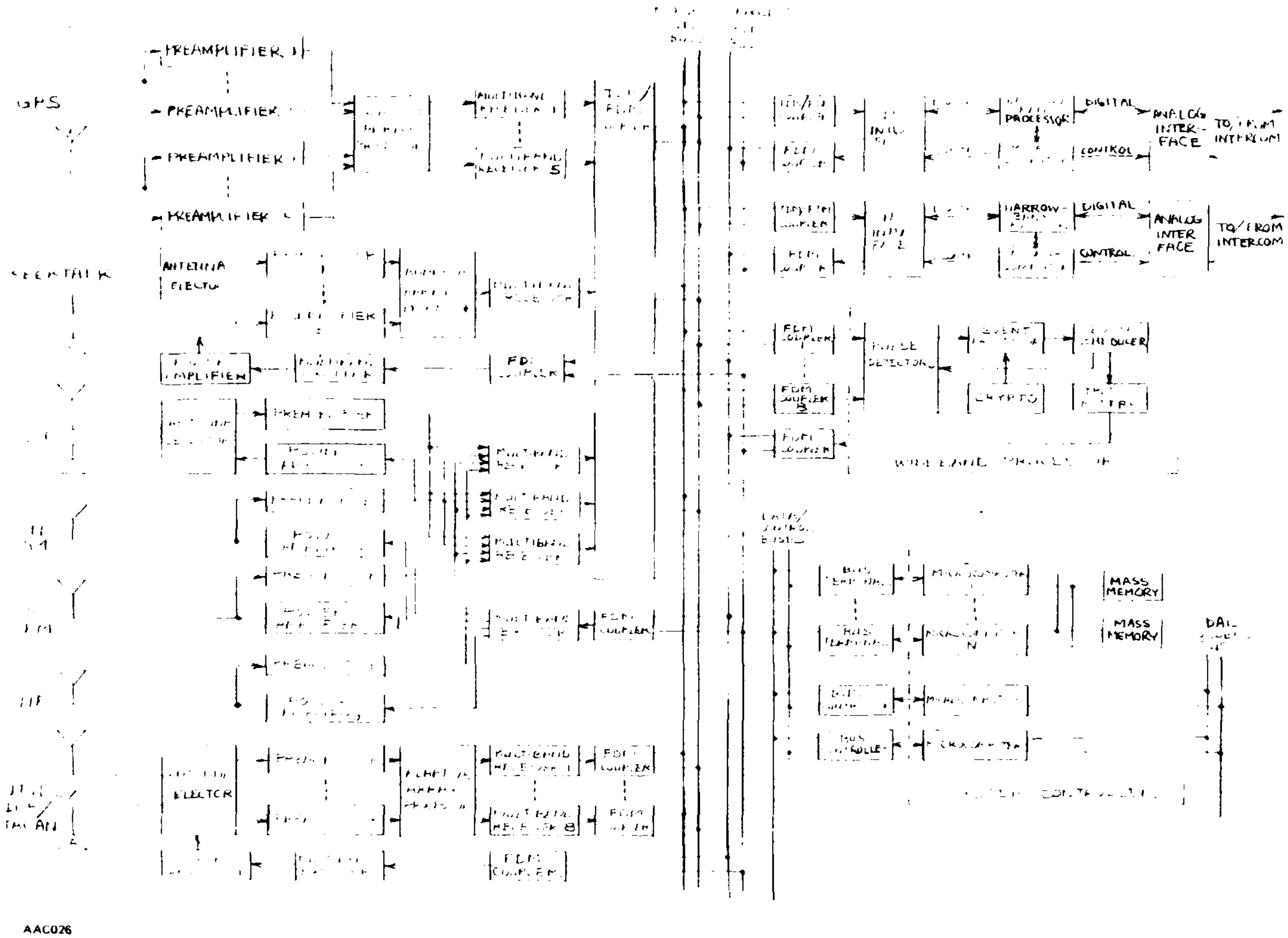


Figure 2.4.3-1. MFBARS Architecture No. 3

Table 2.4.3.1-1. Antennas for MFBARS

FREQ.	POLARIZATION	TYPE	AVAILABILITY AND SIZE
MHz 2-30	V	Isolated Cap	Design as part of vertical stabilizer for each aircraft.
30-400	V	Tail Cap	Development nearly complete. Size: 27"H by 11.25"W by 0.5"D.
30-400	V	Blade	Development nearly complete. Size: 12"H by 12"W by 0.5"D.
200-400	V	Blade	Available off-the-shelf. Size: 7.5"H by 5.0"W by 0.5"D
200-400	V	4-element adaptive array, tunable	Microstrip patch under development. Possible array size: 18"H by 18"W by 0.3"D.
960-1215	V	Blade	Available off-the-shelf. Size: 2.2"H by 3.25"W by 0.5"D.
960-1215	V	4-element adaptive array, tunable	Microstrip patch under development. Possible array size: 12"H by 12"W by 0.3"D.
1227-1575	CP	4-element adaptive array	Microstrip patch under development. Possible array size: 5"H by 5"W by 0.3"D.
1227-1575	V	4-element adaptive array	Microstrip patch under development. Possible array size: 8"H by 9"W by 0.3"D.

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MULTIFUNCTION MULTIBAND AIRBORNE RADIO SYSTEM MFBARS.(U)
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One antenna common to all MFBARS architectures is the HF antenna operating in the 2-30 MHz frequency band. It is designed for all aircraft as an isolated cap antenna along the leading edge of the vertical stabilizer.

Architecture Nos. 3, 4, and 5 show that two VHF antennas are used. One for VHF/AM communication and one for VHF/FM communication. Both antennas are of the blade type, installed at either the bottom or top fuselage. These antennas present significant drag and sideload and, therefore, a tailcap antenna configuration is necessary such as listed in Table 2.4.3.1-1. A single antenna can be used for this task, but requires a multiplexer.

The UHF antenna configuration is also common to Architecture Nos. 3, 4, and 5. It consists of a downward looking five-element adaptive antenna for SEEK TALK and two UHF blade antennas at the top fuselage and one at the bottom fuselage.

In Architecture Nos. 3, 4, and 5, two GPS microstrip patch antennas are used. Both antennas consist of dual mode elements providing good overhead coverage with circular polarization and low angle coverage with vertical polarization. One adaptive antenna covers the L_1 frequency and the second antenna covers the L_2 frequency. These two arrays can be colocated on the same patch. Another possible approach might even offer interleaved arrays. These three approaches might be offered by the GPS adaptive antenna contractor.

The single GPS adaptive antenna for MFBARS Architecture No. 6 consists of five elements and operates at both the L_1 and L_2 frequencies. This particular concept has already been implemented in the High Performance Antenna Assembly (HPAA) as developed for GPS as the AFAL Generalized Development Model User Equipment (GPS/GDM-UE).

Architecture Nos. 3, 4, and 5 have a five-element adaptive antenna for JTIDS. It includes both the TACAN and the IFF function. The adaptive antenna is a bottom fuselage installation. A single combination UHF/L-band blade on the top fuselage serves the JTIDS/TACAN/IFF function.

2.4.3.2 RF CONVERSION – Table 2.4.3.2-1 lists the major characteristics of the module set developed in Architecture Nos. 3, 4, and 5. This module set isolates functions down to the smallest practical increment which has stand-alone utility and at the same time does not allow the overhead costs (BITE, power supply isolation, command interface) to become excessive. Because of this small module size, the module set offers the maximum in user flexibility relative to addition or deletion of specific functions or redundancy. Table 2.4.3.2-2 describes some of the more important characteristics of the module set.

2.4.3.3 WIDEBAND PROCESSOR

Introduction – In Section 2.3.3.1 an analysis of the various MFBARS ICNI signal processing requirements led to the concept of a narrowband and a wideband processor. The narrowband processor is designed to handle those signals where an all digital processing is technically and economically feasible. These signals include standard

Table 2.4.3.2-1. Architecture Nos. 3, 4, and 5, RF Conversion

- Employs smallest practical module size – Further decrease will cause module overhead costs (BITE, power supply, control, housing, etc.) to be an excessive percentage of total cost.
- Small modules allow maximum flexibility in physical location.
- Uses 88 modules of 23 different types, including some multipurpose modules:
  - A broadband downconverter/IF with switched IF/BW
  - A downconverter/IF with 70 MHz CF/Switched BW/Switched LIN/LOG transfer function
  - A Multiband Exciter 70 MHz input/antenna frequency output
  - A Power Amplifier covering all JTIDS, IFF, TACAN requirements
  - A Slow Hop Synthesizer covering all L.O. requirements for 2-400 MHz and IFF, TACAN equipments
- Provides for Time-sharing of the L-band transmit capability of a fast rate ($<20\mu S$)
- Provides for Time sharing of other modules at a slow rate
  - 5 receiver channels serve both GPS frequencies
  - 4 receiver channels switch between IFF/TACAN and JTIDS when JTIDS acquisition is required
  - 3 receiver channels serve all HF, VHF-FM, VHF-AM, UHF-AM, ILS receive functions
  - 1 exciter channel serves all HF, VHF-FM, VHF-AM, UHF-AM power amplifiers

Table 2.4.3.2-2. RF Conversion Module Set (Architectures No. 3, 4, 5)

NO.	MODULE NAME	QTY.	COST	WT.	VOL. CU IN.	PWR.
1	GPS Preamp	5	$ 1,960	5.0	150	5
2	GPS Weighting	2	10,400	16.0	420	20
3	GPS PN Mod.	5	3,300	6.3	150	15
4	Var IF	17	8,800	25.5	510	51
5	70 MHz IF	17	8,400	25.5	510	68
6	GPS L.O.	1	750	1.0	30	6
7	L-Band Preamp Wide	4	1,350	4.0	120	16
8	L-Band Preamp Narrow	4	1,850	4.0	120	16
9	L-Band Weighting	1	5,500	12.0	360	15
10	Fast Hop Synthesizer	2	2,350	4.0	120	20
11	Slow Hop Synthesizer	10	7,650	20.0	600	40
12	Ant. Select	1	600	1.0	30	2
14	L-Band TX	1	3,600	9.0	240	90
15	UHF Pre-Tune	5	2,700	6.2	150	15
16	UHF Weighting	1	6,300	8.0	210	10
17	UHF TX	2	2,650	4.0	300	24
18	Multiband Exc.	3	2,600	4.5	90	18
19	VHF-AM TX	1	1,800	4.0	150	10
20	VHF-FM TX	1	1,700	3.0	120	8
21	HF TX	1	1,900	6.0	180	80
22	VHF-AM Preamp	2	1,600	2.5	60	6
23	VHF-FM Preamp	1	950	1.2	30	3
24	HF Preamp	1	1,000	1.3	30	4
23 Diff.		88 Total	$79,710 Total Cost	174.0	4,680 cu in.	542 Watts

narrowband AM, FM, SSB as well as wideband PN systems such as GPS and SEEK TALK where the spreading code is easily removed in the downconversion process resulting in a low data rate signal behind. The narrowband processor is discussed in detail in Section 2.4.3.4.

The wideband processor is designed to handle the common functions JTID, IFF and TACAN. These three systems not only share the same frequency band 960 to 1215 MHz but their signal structures are all characterized by a system of low duty cycle short pulse bursts of information. In each case the particular information conveyed is related to the time of arrival of these pulses. The wideband processor described here is a fully integrated concept having a minimum of boxes uniquely dedicated to a single function. This processor is not a signal switching circuit which routes a given receiver to a particular unique dedicated box.

System Description – Figure 2.4.3.3-1 shows a system level block diagram of the wideband processor. The major elements are the Event Detector, Event Signal Processor, Event Scheduler, Event Decoder and Aircraft Interface. This architecture was arrived at after a detailed analysis of the signal processing requirements for TACAN, IFF and JTIDS which concentrated on identifying the common generic operations which would lead to a maximized integrated concept.

Event Detector – The Event Detector is designed to accept the 70 MHz IF analog signals of the receive channels and detect valid basic information bursts. When valid bursts are detected, the Event Detector sends a digital message to the Event Signal Processor consisting of a mode indicator, the time of arrival of the event and the event amplitude. The basic bursts processed by this unit are summarized in Table 2.2.2-1. For TACAN the unit recognizes individual 3.5 usec pulses and processes these pulses to identify a pulse pair having the proper spacing which constitutes an interrogation or replys. For IFF the Event Detector indentifies and screens the interrogation pulses, checks the level of the SLS pulse and processes the pulse spacing. In mode 4 IFF the unit recognizes the four pulse preamble and the SLS pulse. JTIDS processing requires two different detections methods threshold, and maximum likelihood. In the first case the SAW correlator output is monitored for a given length of time against a predetermined threshold. A simple 1,0 flag then indicates whether the threshold was tripped during the time interval. In the second case the SAW correlator is sampled every 200 nsec bit for the 32 bit duration of a pulse. The largest of these samples is determined and is tested against a threshold for an erasure. The TOA of the largest sample corresponds to the particular 5 bits of information.

The signal processing tasks required of the Event Detector are best accomplished via the basic architecture shown in Figure 2.4.3.3-2. Each receive IF channel is followed by a pulse detection module which is capable of processing IFF, TACAN or JTIDS type signals. This module contains the SAW JTIDS correlator, the TACAN half amplitude detector and the IFF log video amplifier and threshold detectors. All pulse width screening circuity is included as well. When a valid pulse is detected a strobe reads the system clock time into the memory which is combined with appropriate amplitude information and a mode flag. From this point on all signal processing is performed in the digital domain. Note that each module has full JTIDS, IFF, and TACAN capability. The JTIDS correlator is

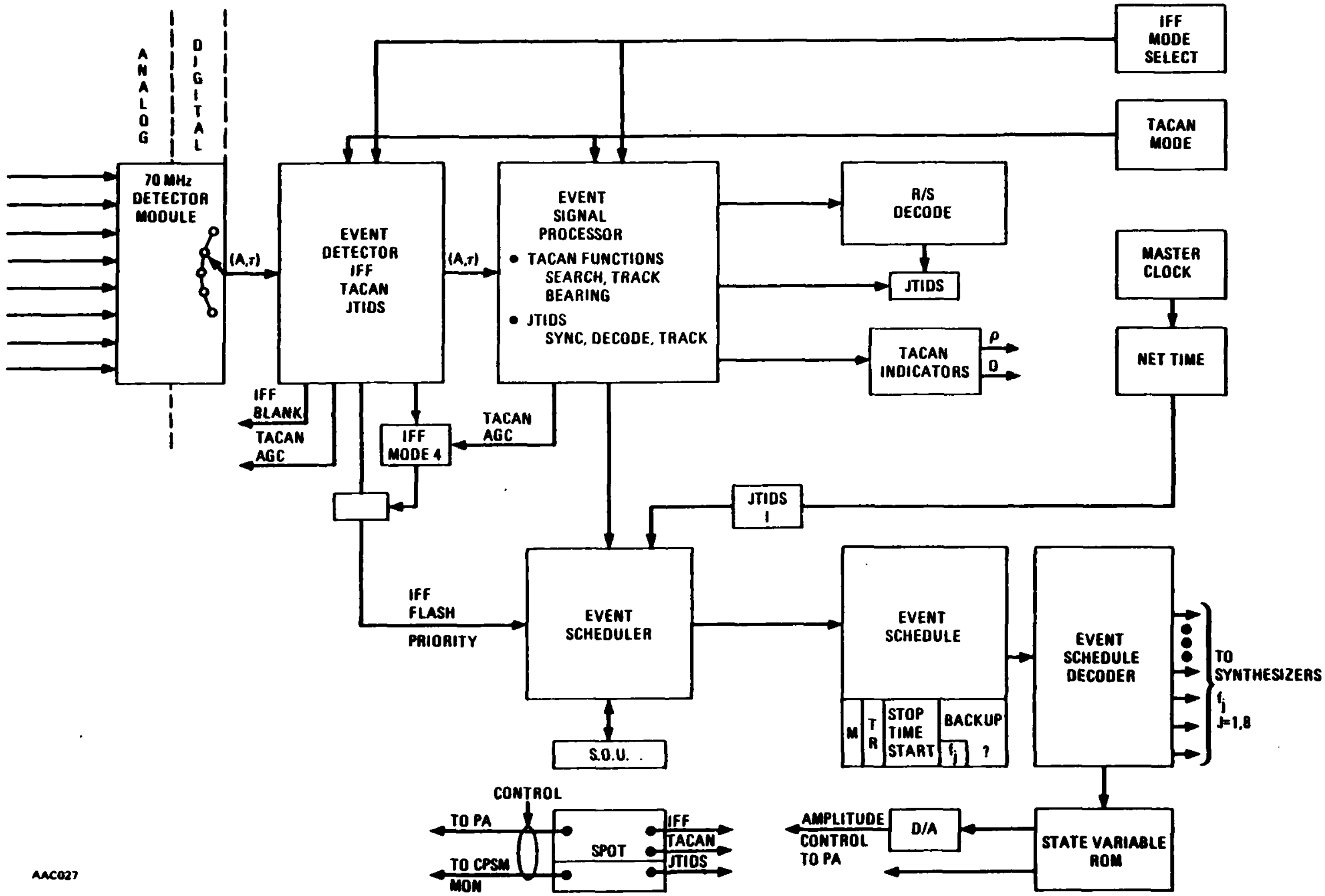

Figure 2.4.3.3-1. System Level Block Diagram

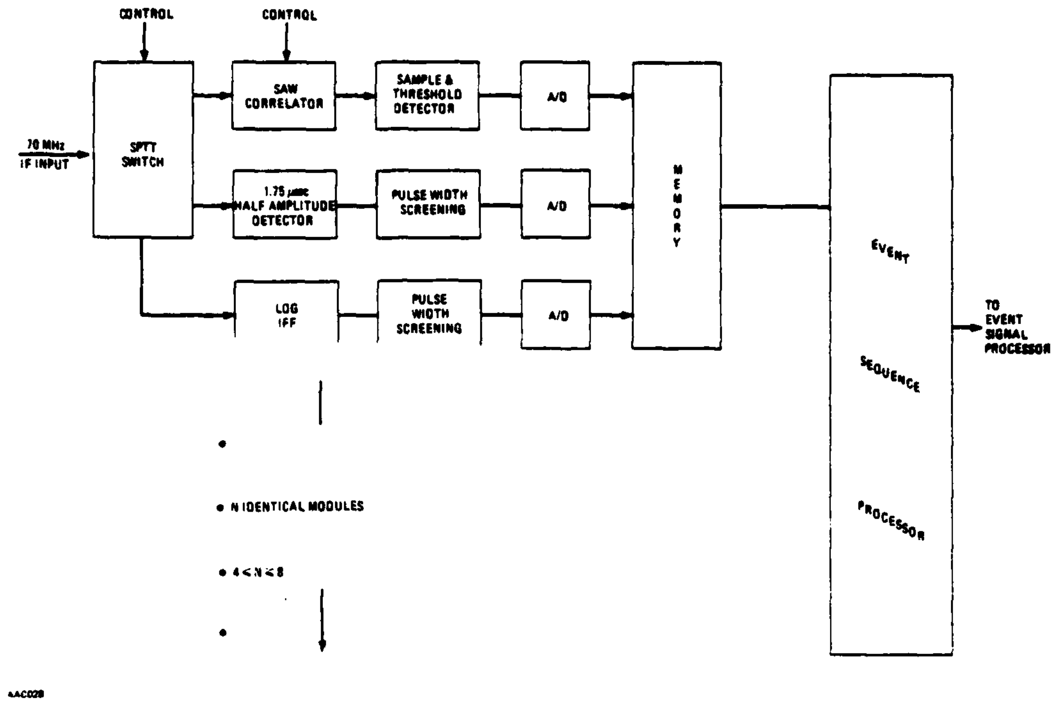

Figure 2.4.3.3-2. Event Detector

mandatory for sync purposes and is the driving cost fact. The slight additional cost to duplicate the TACAN and IFF detectors is overcome by the increase in system flexibility and increased redundant reliability this concept provides.

A shown in Figure 2.4.3.3-2 each detector module contains its own memory which is read by the event burst processor. An alternative configuration would be to attach a single large memory to the event burst detector which is addressed by individual detector modules which have no memory capability. A trade-off study will be performed during the next phase to determine the most cost-effective approach.

The next part of the Event Detector is essentially a fast microprocessor. The basic task of this unit is to process the individual pulse burst information just described to determine valid events. For example, in the IFF mode the microprocessor will scan the receiver detector module memory for indications of valid pulse events and then process these individual events to ascertain whether a valid interrogation has occurred. This processing includes verifying proper pulse spacing and checking the level of the SLS pulse. TACAN processing proceeds in a similar manner. For JTIDS sync the microprocessor checks each unit to see if the threshold has been crossed during the given time window. The particular sync pattern to be recognized has been stored in memory and the Event Processor continually compares the status of the received threshold patterns against the reference.

The output of the Event Detector is routed to the Event Signal Processor for further action.

Event Signal Processor - The Event Signal Processor accepts information from the Event Detector. The received information is still in the form of TOA, amplitude data and a mode indicator. The actions taken by the Event Signal Processor are quite diverse. However, the low duty cycle nature of the basic systems being processed permits a sequential type time-shared architecture.

When operating in the normal mode IFF the Event Signal Processor immediately requests a reply by direct access to the Event Decoder. The Event Scheduler is bypassed in this case to avoid processing delays. If the mode 4 IFF is active the Processor address the mode 4 computer which examines the ensuring pulse train information. If a valid interrogation is detected the mode 4 computer generates the reply pulse train and quest the Event Decoder for action.

The Event Signal Processor is capable of all required signal processing functions of the TACAN system. This includes amplitude demodulation of the 15 Hz and 135 Hz signals for extracting bearing information and round-trip timing to determine range. The TACAN search and track algorithms are processed as well. The JTIDS Reed/Solomon decoder is resident in the Event Signal Processor, and is utilized as required. Additional JTIDS synchronization and tracking operators include calculating RTT time information, and tracking the various user source synchronization signals. The JTIDS tracking algorithms are quite similar to those required by the TACAN system and both systems can time share a signal microprocessor.

Event Scheduler - The Event Scheduler is the heart of the wideband processor. This unit is responsible for establishing the system time base, schedule events into the Event Decoder, monitor the output of the Event Signal Processor and interface with the Secure Data Unit and other crypto devices.

The system time base will be derived from the JTIDS timing requirements and will be based on the Event Concept. For DTMA the basic event time is chosen to be 12.8 usec. For the rigid TDMA analysis shows that there is no one good timing increment corresponding to the DTMA 12.8 usec event. The TDMA time slot of 7.8125 msec is not evenly divisible by 12.8 usec, or 13.0 usec. It is however logical to establish an event timing concept which preserves the time slot integrity, i.e., an event can never stradle the timing mark from one time slot to the next. The resolution of this problem is to have an event time duration which can be varied. An analysis of the simplest scheme to meet all requirements is underway.

The remaining system operates in an identical manner independent of the time base chosen. Event actions will always be translated into storage bins. There is no separate processor operations between the two JTIDS systems. The system time base then controls the JTIDS events to be scheduled as well as obtaining from the secure Data Unit relevant parameters of the event, including transmission or reception frequency, sync codes, interleaving parameters, baseband encryption bits, and 32 bit TRANSEC PR bit patterns.

The Event Scheduler also monitors the Event Signal Processor to obtain synchronization data from which to calculate receive events for JTIDS and TACAN which have been calculated from the tracking loops. Additionally the Aircraft Interface Unit is monitored for requests to transmit TACAN or IFF interrogations.

A key element of the Event Scheduler is the implementation of the priority/protocol to be used. The various priority systems are discussed in Section 2.2.2. With the exception of the IFF reply request, all events will be scheduled by the Event Scheduler to be processed by the Event Decoder. The event parameters will be written into a memory which corresponds to the particular basic time unit concerned. The information stored is the event start and stop times, event mode, frequency assignment, the particular 32 bit pattern for a JTIDS transmission, the appropriate IFF reply messages and an event priority indicator. In addition, for lower priority events an alternate event time is included where possible. When a request of event action is presented, the Scheduler determines the appropriate timing requirements and checks the event memory list resident in the Event Decoder. If the Event can be scheduled without conflict it is processed accordingly. If the event cannot be scheduled without conflict with an existing request a resolution must be made. In this case the priority of each is examined with the higher priority taking precedence. The lower priority event is not immediately discarded however. Instead the alternate scheduling possibilities of this event are examined and if possible the event is rescheduled. Depending on the priority system chosen, a floating priority of each event could be incorporated. In this case each time a given event was superseded by one of higher priority, the deleted event would have its priority increased until it could no longer be eliminated.

Event Decoder – The Event Decoder is charged with commanding the system resources required to execute an event. The Decoder reads the information contained in the schedule memory such as the event mode, frequency and exact timing. Based on this data the appropriate synthesizer is commanded on frequency and if a transmit event, the modulation requirements are identified and the proper formatting and routing is established.

2.4.3.4 NARROWBAND SIGNAL PROCESSORS – Two narrowband signal processors perform all the digital signal processing functions for conventional HF, VHF and UHF voice and data communication, GPS, SEEK TALK and adaptive antenna array processing. We considered using analog circuits for some of these functions and determined that no appreciable cost saving could be obtained. Since digital processing is cost effective and necessary for GPS and SEEK TALK processing of conventional communication functions require only a small increase in memory for additional storage of programs and state variables in the narrowband signal processors. Actually there are performance advantages for digital signal processing. For instance bandpass filters can be matched to the specific function being performed, i.e., high selectivity for AM and SSB voice or linear phase for data communication and FM.

The processors interface with the signal distribution system on one side and the DAIS and intercom system on the other side. The signal distribution interfaces provide time division multiplexed sequences to the narrowband processors. These consist of either multiplexed samples of the IF signals themselves or digitized samples of these as is the case for architecture 4.

The digital processing of these samples is carried out by timeshared digital processors which perform the equivalent functions of lowpass and bandpass filtering, modulation, demodulation, frequency translation, and gain and volume control. Because the actual

processing algorithms are stored in the processor memories the mode of operation for each channel is under software control. The tasks of the narrowband signal processor include frequency translation, recursive and non-recursive digital filtering, matched filtering, modulation and demodulation. It is possible to implement all these tasks with signal processing algorithms that require multiplication addition and memory access. Trancendential functions can be handled through ROM look-up tables.

By timesharing a multiplier, an adder and multiple access memory in a pipelined structure it is possible to minimize cost for a given performance level. Since the multiplier normally is the most expensive part of a communications signal processor the best performance/cost ratio is achieved when the multiplier operates continuously at the maximum guaranteed speed. The approach to the narrowband signal processor that we have implemented in ECL and TTL technology for various programs is based on this principle. Every clock cycle new data is fed to the multiplier, and by using efficient signal processing algorithms, the processing capability is maximized. Other approaches to the narrowband processor[1] provide simpler software and a wider variety of signal processing functions. Approaches such as the Micro Signal Processor may result in large quantity production leading to low unit cost modules which may compete with the cost of the simpler but more limited narrowband signal processor approach taken by General Dynamics. For this phase of the MFBARS study we have based the hardware estimates on our cost effective design and used the technology which can be expected to be available in 1985.

The theory of operation of the narrowband signal processor was developed under an AF contract[2] and GD funded IRAD programs.

2.4.3.4.1 Bandpass Sampling – If a band-limited waveform is sampled at a uniform and sufficiently high rate, the original waveform can be reconstructed from the sampled values by appropriate interpolating functions. The well-known theorem by Shannon states that the minimum sampling rate is equal to twice the highest frequency component. However, for bandpass signals it is sufficient to take 2 B independent samples every second, where B is the difference between the highest and the lowest frequency components, or the bandwidth of the signal. Thus, the sampling rate for bandpass signals can be as low as twice the bandwidth instead of twice the highest frequency.

A bandpass signal of bandwidth B can be translated down in frequency to a lowpass signal by proper selection of the sampling rate. Consider the bandpass signal s(t) whose Fourier Transform is given by S(f), as shown in Figure 2.4.3.4.1-1. The signal is confined to the intervals $f_L > f > f_L + B$. The lower frequency f_L is an integer multiple of the sampling frequency f_s, i.e., $f_s = f_L/k$, with k an integer.

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[1] G. N. Shapiro, "High Speed Micro Signal Processor Study", Report AFAL-TR-77-52, September 1977.

[2] B. Bjerede, et.al., "Digital Processing Receiver", Final Technical Report, RADC-TR-75-44, February 1975.

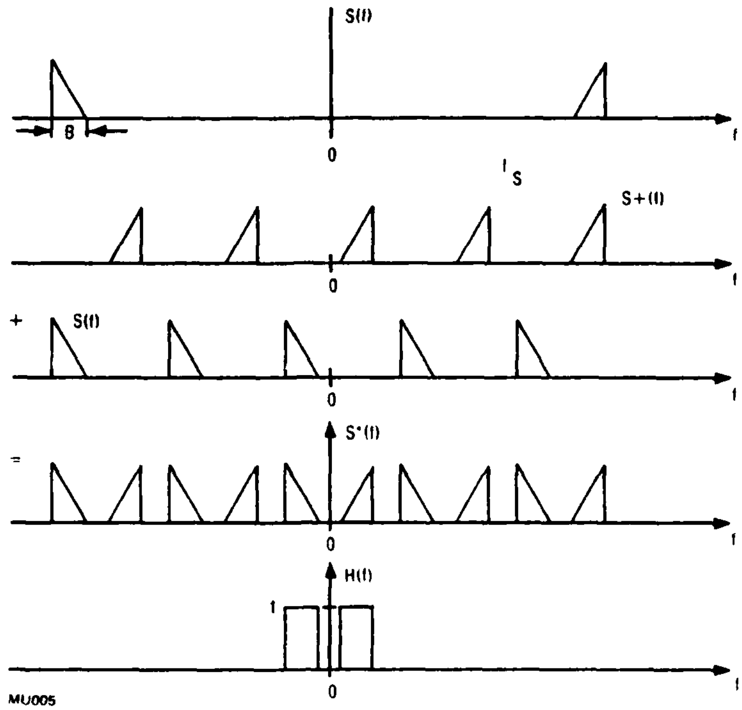


Figure 2.4.3.4.1-1. Spectrum of Regular Bandpass Sampling

The negative and positive portions of the spectrum are repeated at intervals of kf_s and the combined spectra is indicated as S*(f) in the figure. Note that all the information originally contained in the bandpass spectrum now appears as a repetitive lowpass spectrum repeating every f_s cycles.

The original time waveform can be reconstructed from the sampled one by using a filter with a response, as shown in Figure 2.4.3.4.1-1. In other words, the sampled values will be interpolated by the impulse response of the filter. Let b(t) be the impulse response of an ideal bandpass filter, centered at frequency f_c and with a bandwidth B, i.e.,

$$h(t) = \cos 2\pi f_c t \frac{\sin \pi Bt}{\pi Bt}. \tag{2-1}$$

LET S(nT) be the sampled values of s(t); then the output of the filter is given by:

$$s(t) = \sum_{-\infty}^{\infty} s(nT) \cos 2\pi f_c (t-nT) \frac{\sin \pi B (t-nT)}{\pi B (t-nT)} \tag{2-2}$$

To prevent the sampled spectra from overlapping, the following restraint must be satisfied:

$$f_s \geq \frac{2f_H}{\mathrm{INT}\,(f_H/B)} \tag{2-3}$$

where INT means integer values of x and $f_H = f_L + B$. As shown in Figure 2.4.3.4.1-2 the minimum sampling rate is between 2B and 4B.

The sample and hold circuit serves a dual purpose in a digital processing receiver: (1) it provides the A/D converter with a voltage which remains constant during the conversion process and (2) it performs the function of frequency translation. The first task is not a major problem in this case because of the relatively low sampling rate. The second task influences the performance mainly because of the aperture time.

As shown in Figure 2.4.3.4.1-3, the aperture time is the uncertainty in the sampling instant. It should not be confused with the acquisition time, which is the time necessary to acquire and track the input signal. Since the sampled signal is a bandlimited carrier, the slowly varying amplitude and phase will not change significantly during the aperture time. The timing error of the sampling instant t_a is, therefore, equivalent to a phase error ϕ_a of the carrier

$$\phi_a = 2\pi \frac{t_a}{T_c} = 2\pi f_c t_a \,, \tag{2-4}$$

where f_c is the carrier frequency and $T_c = 1/f_c$ is the period of the carrier. For example, assuming a typical high-speed sampler with an aperture time of 0.2 nanosec, and assuming the carrier frequency is 10 MHz, the equivalent phase error is 4×10^{-3} radians

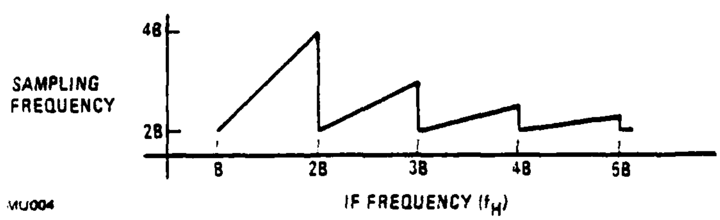


Figure 2.4.3.4.1-2. Minimum Sampling Frequency versus Maximum IF Frequency

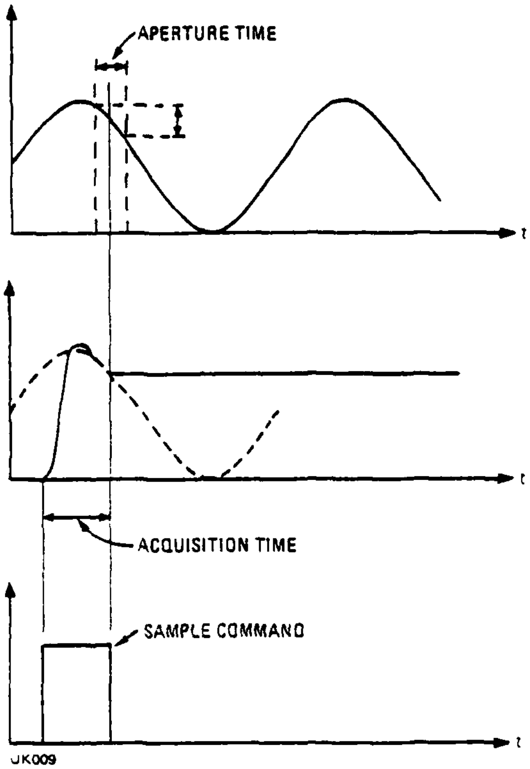


Figure 2.4.3.4.1-3. Aperture Error

or 0.7°. The effect is the same as that if the carrier were phase modulated by a random variable with a magnitude of always less than 0.7°. In an AM system this will have negligible effect. In an FM system the phase changes from sample to sample correspond to an equivalent frequency modulation. For instance, under the conditions of the example above and with a 3 kHz audio bandwidth, the equivalent frequency deviation will be 5 Hz, which is negligible compared to the 5 kHz peak deviation specified for FM and FSK operation.

For SSB the effect of the equivalent phase modulation of the carrier is an identical phase modulation of the baseband signal. A phase modulation of less than 0.7° will have no audible effect.

2.4.3.4.2 Digital Filters – A digital filter is a discrete filter involving a defined computational process or algorithm. The algorithm performs a transformation of a digital input signal (or sequence of numbers) into a second sequence of numbers termed the digital output signal. The function of the digital filter, like the continuous-time filter, is to achieve desired frequency selectivity and spectrum shaping of the digital signal applied at its input.

Digital recursive filter realizations are based on an infinite-duration impulse response (IIR). IIR implies that no finite values of either N_1 or N_2 satisfy the equations

$$\left.\begin{array}{ll} h_n = 0 & N_1 < n < \infty \\ h_n = 0 & -\infty < n < N_2 \end{array}\right\} \begin{array}{l} N_1, N_2 \text{ finite} \\ N_1 > N_2 \end{array} \quad ; \qquad (2\text{-}5)$$

that is, the impulse response persists for an infinite number of samples.

The z-transform of the impulse response h_n defines the system transfer function:

$$H(z) = \sum_{n=-\infty}^{\infty} h_n z^{-n} . \qquad (2\text{-}6)$$

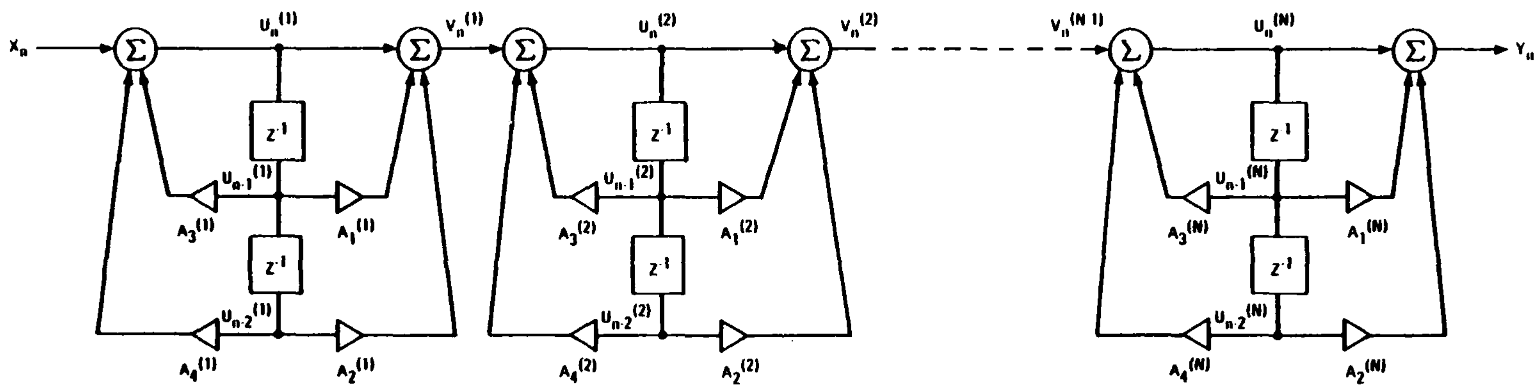
The general form of system transfer functions which allow a linear time-invariant recursive realization is given by

$$H(z) = \frac{\sum_{k=0}^{k_1} B_k z^{-k}}{\sum_{k=0}^{k_2} A_k z^{-k}} , \left\{ \begin{array}{l} k_1 \leq k_2 \\ a_o = 1 \end{array} \right. , \qquad (2\text{-}7)$$

where A_k and B_k are real polynomial coefficients.

The central-delay canonic form configuration was chosen for our filter realizations. It allows convenient implementation and requires a minimal number of multiplications and delay cells. Figure 2.4.3.4.2-1 illustrates the implementation of an N-section central delay recursive digital filter; as shown, input samples x_n are processed to generate filtered output samples y_n.

The design of digital filters in a recursive form normally begins with specification of an appropriate continuous-time filter described in terms of the Laplace Transform complex variables. An approximation technique is then required to find a suitable transfer function H(s) which may be efficiently transformed into a digital transfer function H(z). Function H(z), described in terms of the unit delay variable z^{-1}, is derived by the bilinear z-transform for our narrowband processor.



i^{TH} SECTION

$$\left.\begin{aligned} U_n^{(i)} &= V_n^{(i-1)} + A_3^{(i)} U_{n-1}^{(i)} + A_4^{(i)} U_{n-2}^{(i)} \\ V_n^{(i)} &= U_n^{(i)} + A_1^{(i)} U_{n-1}^{(i)} + A_2^{(i)} U_{n-2}^{(i)} \end{aligned}\right\} \Longrightarrow$$

DISCRETE-TIME OUTPUT LEVELS

$$Y_n = X_n \prod_{i=1}^{N} \frac{U_n^{(i)} + A_1^{(i)} U_{n-1}^{(i)} + A_2^{(i)} U_{n-2}^{(i)}}{U_n^{(i)} - A_3^{(i)} U_{n-1}^{(i)} - A_4^{(i)} U_{n-2}^{(i)}}$$

U = STATES FROM SPECIFIED SAMPLING TIMES
Z = DELAY SHIFTERS
A = MULTIPLIER COEFFICIENTS

UK018

Figure 2.4.3.4.2-1. Basic N-Section Central-Delay Form Recursive Filter

A recursive realization indicates that filter output samples are explicitly determined as a weighted sum of past output samples and past or present input samples. If x_n and y_n are present input and output samples, respectively, then

$$y_n = f(x_n, x_{n-1}, \ldots, y_{n-1}, Y_{n-2}, \ldots) \text{ for all n.} \quad (2\text{-}8)$$

This bilinear z-transform is especially suited to digital computer synthesis and retains properties of stability, cascading, and ease of application. The approach circumvents the aliasing problem of the standard z-transform and uses the algebraic transformation

$$s = \frac{2}{T_s} \frac{1 - z^{-1}}{1 + z^{-1}} \quad (2\text{-}9)$$

to derive the system function of the digital filter, where s is the Laplace transform variable and T_s the sampling period. The z-plane transfer function is given by

$$H(z) = H_c(s) \Big|_{s = \frac{2}{T_s} \frac{1-z^{-1}}{1+z^{-1}}} . \quad (2\text{-}10)$$

The transformation of Equation 2-9 has the effect of mapping the left-half s-plane inside the unit circle and the right-hand s-plane outside the unit circle in the Z-plane. A nonlinear frequency warping results from a direct transformation according to the relation

$$\omega_c = \frac{2}{T_s} \tan \frac{\omega_d T_s}{2} , \quad (2\text{-}11)$$

where ω_c and ω_d are the continuous and discrete-time frequencies, respectively. Pre-warping of critical frequencies of the continuous-time filter may be applied using Equation 2-11 with assurance of a constant passband and stopband response.

The recursive digital filters will be developed to be compatible with conventional bandpass sampling techniques. The filters to be used must, of necessity, perform as bandpass filters and must meet the specifications set forth to provide equal or superior performance to corresponding analog filters.

2.4.3.4.3 Digital Demodulation - The digital signal processor is required to extract the baseband signals with an efficiency equal to or exceeding that of the existing analog

hardware. Important factors to consider in demodulator designs are threshold performance, output signal-to-noise-ratio (SNR) for high carrier-to-noise ratio (CNR), linearity, complexity, and flexibility.

Output SNR for high CNR and linearity are closely related to the quantization noise and, consequently, to the word lengths. The threshold performance of the demodulator directly determines the sensitivity of the receiver. The threshold level is proportional to the predetection bandwidth for AM envelope detection and FM detection. It is therefore important to keep the predetection bandwidth to the minimum necessary to pass the modulated signal without distortion. However, this is not the case for product demodulation.

SSB and FM demodulation are discussed with reference to the sampling method. Regular bandpass sampling lends itself to different kinds of demodulation schemes and, as a general rule, most readily to equivalency demodulation schemes. AM is most easily obtained by the equivalent of full wave envelope detection. This merely involves complementing all negative samples and digital lowpass filtering.

2.4.3.4.3.1 <u>AM Demodulation</u> – Demodulation of AM and amplitude shift keying (ASK) modulation signals is accomplished by a multi-sample estimation technique. The implementation computes the sum of square roots of the sum of squares of each pair of consecutive samples. Initially, two and three-sample estimators were attempted; however, excessive amplitude modulation of steady-state response due to beat frequencies necessitated using five samples. The five-sample estimator provides sufficient smoothing of the filter output waveform and effectively removes high frequency modulation due to finite sampling rates. The equation describing the demodulator operation is

$$g(n) = \sqrt{y(n)^2 + y(n-1)^2} + \sqrt{y(n-1)^2 + y(n-2)^2} + \sqrt{y(n-2)^2 + y(n-3)^2} + \sqrt{y(n-3)^2 + y(n-4)^2} \qquad n = 0, 1, 2, \ldots \tag{2-13}$$

where y(i) are filter output samples and n is the sample number.

For the digital AM demodulator, Figure 2.4.3.4.3.1-1, one multiplication, one square root, and four additions are required in the realization. No additional filtering is needed and the demodulator output g(n) becomes the processor output.

Figure 2.4.3.4.3.1-2 shows the response of the 1 kHz elliptic bandpass filter of the example in Section 2.3. The filter response was simulated using 8-bit coefficient and 22-bit state variable precision followed by a five-sample estimator AM demodulator. The input to the filter was a fixed level (unmodulated) sinusoid centered at 16 kHz. Note that there is a 4 microsecond transient due to the presence of the equalizing filter sections. After 8 microseconds, the output level is a steady and constant dc level.

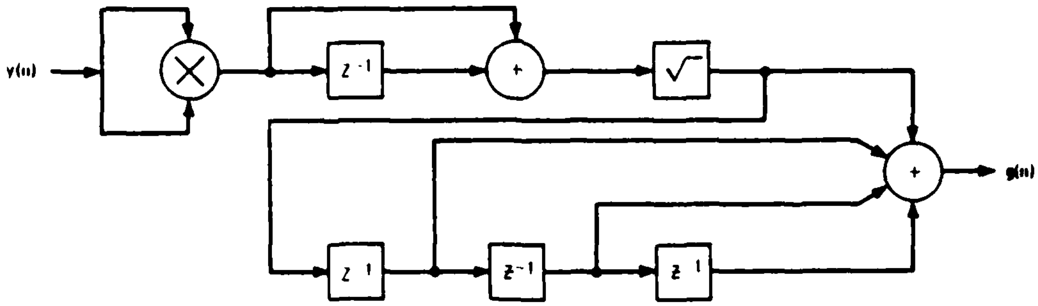


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Figure 2.4.3.4.3.1-1. Five-Sample Estimator Digital AM Demodulator

2.4.3.4.3.2 FM Demodulation - Frequency shift keying (FSK) and FM demodulation require an FM demodulator following the bandpass filter. Digital FM demodulation is most efficiently achieved by computing the product of each pair of consecutive output filter samples. This product is then passed through a lowpass filter to remove the carrier and higher order distortion components. Figure 3-10 shows the implementation of the digital differential FM demodulator with a single section recursive lowpass filter.

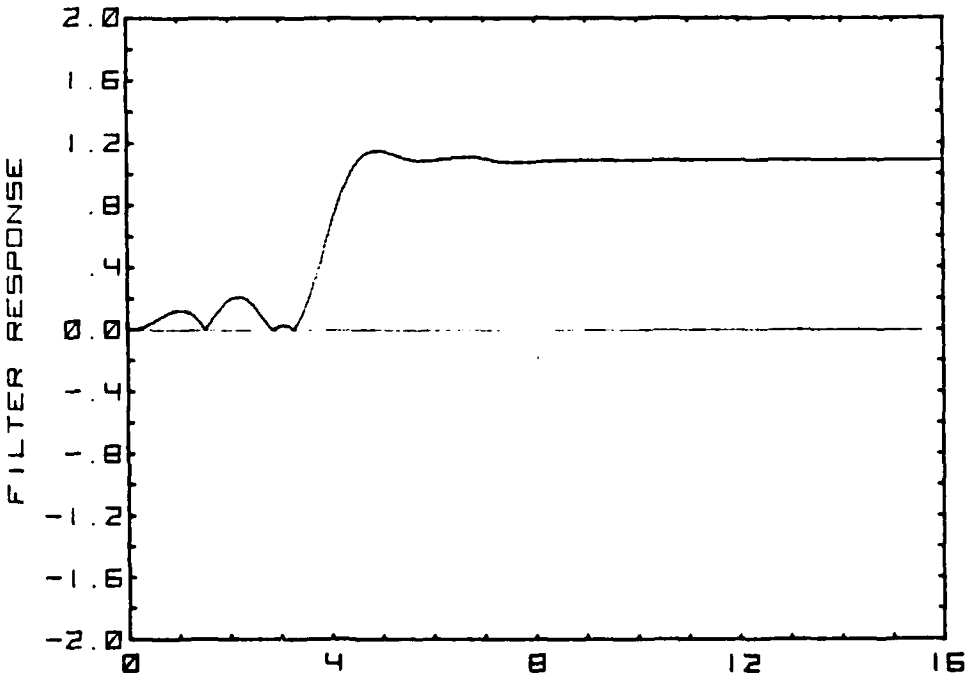

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Figure 2.4.3.4.3.1-2. Filter Response Versus Time, 1 kHz Elliptic BP Filter, Equalized, States and Coefficients Quantized With AM Demodulator

The lowpass filter must be designed with a corner frequency beyond the maximum data rate to be processed. It must provide sufficient transition roll-off to eliminate the carrier and allow a smooth, steady-state output response with minimum arithmetic operations. Investigation showed 2-pole Butterworth filters to be the optimum choice; accordingly, they were employed as shown in Figure 2.4.3.4.3.2-1

2.4.3.4.3.3 Single Sideband Demodulation – Single sideband voice reception for regular bandpass sampling requires processing regular bandpass sampling upper or lower sidebands (USB, LSB) using a SSB filter with sharp transition regions. The SSB recursive elliptic fiters provide a 3 dB attenuation at $f_o \pm 0.3$ kHz, and more than 40 dB rejection of the carrier and undesired sideband. Demodulation is accomplished by the SSB product demodulator shown in Figure 2.4.3.4.3.3-1. Because the sampling rate f_s is exactly four times the carrier frequency, the injection signal for the equivalent product demodulator can be represented by four samples spaced T_s seconds apart. The injection signal then corresponds to samples of a 16 kHz sinewave spaced 90^o apart with magnitude ± 1. The demodulator output, x(n) V(n), is sent to a 2-pole Butterworth lowpass filter to eliminate higher order frequency components and to pass only the desired signal.

2.4.3.4.4 Hardware Implementation – A block diagram of the processor is shown in Figure 2.4.3.4.4.-1. The commutator selects data from the IF bus coupler, audio or data modulation sources for each channel to be processed. The IF signals are already time division multiplexed which makes it possible to time share a single IF port for all the receive channels to be processed simultaneously. The demultiplexer controls the flow of output signals. The IF output contains a time division multiplexed sequence for all the transmit signals to be processed simultaneously. Separate audio and data outputs are also provided. The intercom interfaces with the audio in/out ports. The processor has the capability of outputting several voice channels simultaneously over the audio out terminal.

Processor control, including receive/transmit mode, channel number, filter bandwidth, modulation and demodulation mode is managed by a general purpose microprocessor. A Processor Control Memory which is addressed sequentially by the address counter controls all addresses switch settings, read/write status, input and output control for the

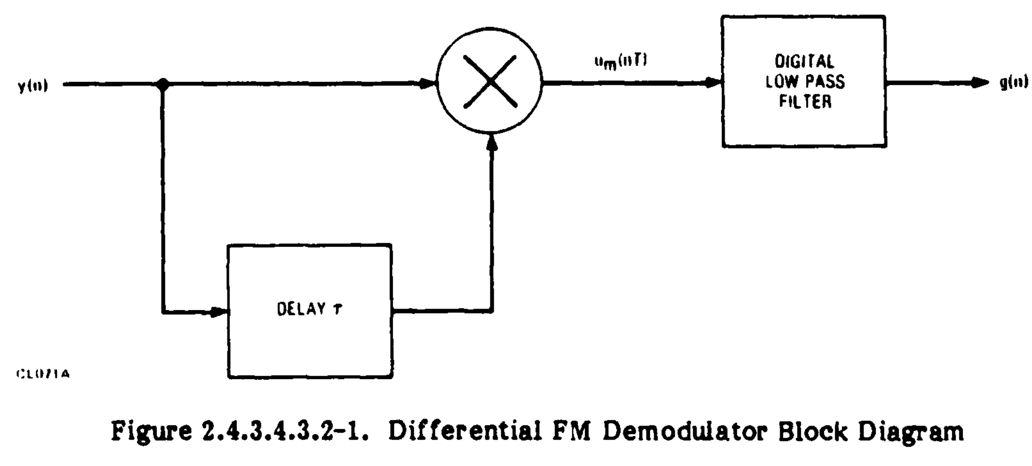


Figure 2.4.3.4.3.2-1. Differential FM Demodulator Block Diagram

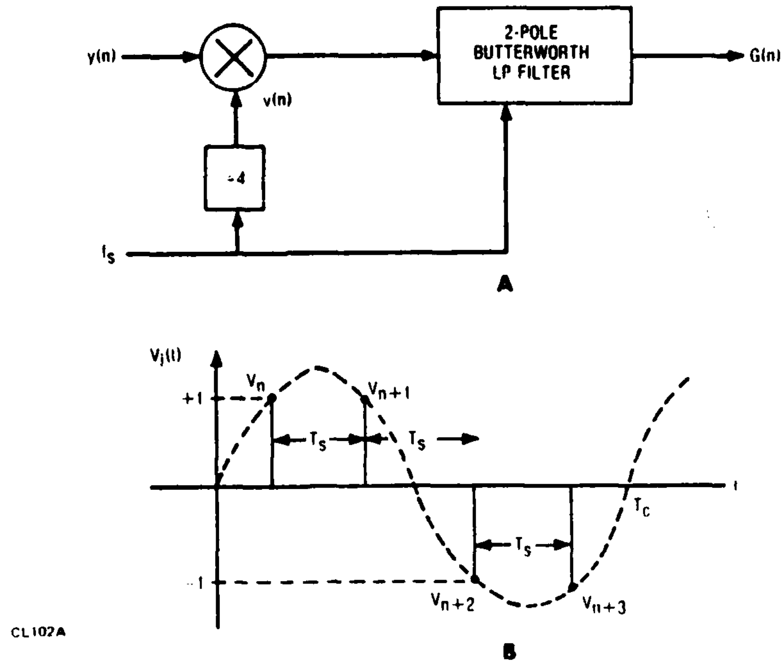


Figure 2.4.3.4.3.3-1. Single Sideband Product Demodulator

high speed processor. The filter coefficient memory and the processor control memory are initially loaded from an image stored in the microprocessor RAM. The state variable RAM stores all the intermediate filter variables, and the temporary storage is a scratch pad memory used for modulation demodulation.

2.4.3.5 INTERNAL SIGNAL AND DATA DISTRIBUTION – Architectures 3 and 6 feature four separate redundant buses as described in Table 2.4.3.5-1. Prior to coupling the signals onto the receive bus they are normalized by AGC to a level of about -10 dBm in order to minimize crosstalk between channel and to assure that the harmonics of the 70 MHz input that are created in the up conversion process will be sufficiently low level that they will not present problems. The losses associated with conversion filtering and coupling are about 54 dB, however, there is sufficient gain to prevent sensitivity degradation.

The transmit signals are coupled onto the transmit FDM bus at a higher level using very high level mixers so as to minimize the transmitted noise pedestal.

2.4.3.6 CONTROL STRUCTURE – The control structure for Architecture No. 3 is a combination of central control and distributed control. The central control is provided for by the system controller which receives commands from the pilot for control of the MFBARS functions via the DAIS system. Basic commands would consist of pilot selection of receive and transmit channels or frequencies. Special commands can be handled by the MFBARS control structure by providing the system controller with the

Table 2.4.3.5-1. Internal Signal/Data Distribution Architectures 3 and 6

Four Separated Redundant Buses
• Combination TDM/FDM Receive Bus
TDM of Narrowband Signals with 70 MHz Carrier FDM of Wideband Signals by Up-Converting to UHF
• FDM Transmit Bus by Up-Converting to UHF
• General Purpose Command/Data Bus
• High Speed Command Bus for Time Critical Commands
Each Module Addressed Directly From Central Processor

proper software program module. For special mission situations, for example, it would be possible to have MFBARS automatically scan selected for specific frequencies or frequency bands for activity. Different scanning programs could be established for different mission phases or for different types of missions. The integrated MFBARS architecture allows complete flexibility in choosing the frequencies for receive and transmit operations.

In addition to the control of frequencies to be utilized, the system controller also handles JTIDS data to be transmitted and the data received from other JTIDS terminals. Data to be transmitted on the JTIDS network is received by the system controller from the other aircraft systems via the DAIS data bus. The system controller will transfer this data to the wideband processor (see Section 2.4.3.3.1). The received JTIDS data will be transferred from the wideband processor to the system controller. The received data will be filtered by the system controller and only the selected data will be displayed to the pilot via the DAIS system.

The system controller also will receive range measurement data to other JTIDS terminals in the network from the wideband processor and pseudorange measurement data to the GPS satellites from the narrowband processor. This data will be processed in the system controller to provide for JTIDS relative navigation and GPS absolute three dimensional position and velocity.

Distributed control is implemented by a microcomputer which is a part of each MFBARS module. Each module receives commands from and returns status information to the system controller. All control sequences required by the module are generated by the microcomputer which is a part of the module. Thus, detailed control sequences do not need to be transferred over the data bus that interconnects the system controller and the individual modules.

2.4.3.7 EXTERNAL SIGNAL/DATA INTERFACES – The following is a list of the major signal/data interfaces with the other avionics systems on a typical aircraft:

a. DAIS

1. Selection from DAIS of receive and transmit frequencies, operating modes and functions.

2. Transfer from and to DAIS of JTIDS data to be transmitted or received.

3. Transfer of navigation data to DAIS.

4. Acquisition/aiding data via DAIS.

b. Intercom

1. Three voice channels to the intercom system.

2. One voice channel from the intercom system.

2.4.3.8 ELECTRICAL POWER CONVERSION CONTROL AND DISTRIBUTION – A common form of electrical power subsystem has been used for all integrated Architectures 3, 4, 5, 6 and 7. Table 2.4.3.8-1 summarizes the more important characteristics of the proposed architecture. While the basic concept was developed using Reference 1 as a starting point it has features which encourage but does not require users to employ a family of standard voltages. Furthermore it addresses the problem of bus protection, load control, load sharing and distribution line drop and EMI pickup which were not fully considered in Reference 1 since some of these problems are unique to a MFBARS approach.

Reference 1: AFAL Technical Report AFAL-TR-78-59 Feb 78.

Table 2.4.3.8-1. Electrical Power Conversion, Control and Distribution

- All Integrated Architectures 3, 4, 5, 6, 7 Identical
- Features

  Stand-alone converter with family of coarsely regulated voltages

  Easy addition of more capacity by paralleling modules

  Automatic adjustment for changes in load distribution

  Fine regulation, isolation, control in each user module

  Unique stand-alone converters for unique requirements

2.4.3.10 PACKAGING CONCEPT – Schedule and funding limitations have prevented a complete evolution of a packaging concept, however, some preliminary conclusions and desirable characteristics are contained in Table 2.4.3.10-1. The Hughes packaging concept[1] is a good starting point for the final package, however, it appears that some modifications may be desirable to retain full flexibility of the MFBARS approach. With MFBARS the module set within an enclosure will be user specified and therefore there is no a priori knowledge of the mix between analog, digital and RF modules, the heat dissipated by neighboring modules or the EMI problem between neighboring modules. Because of this it appears desirable to develop a single EMI shielded package which is suitable for all types of circuitry. Such a conclusion appears to result in unnecessary costs to digital and analog modules, however, since 75 to 80% of the module set is RF

[1]Draper Lab Report April 78 Volume 1 "GPS/JTIDS/IFF Integration Study"

Table 2.4.3.10-1. Packaging Concept Architectures 3, 4, 5, 6, 7

Preliminary Results

- Specify Only Mechanical and Electrical Interface
- Minimum Module Size Approximately 5 x 6 x 1 inches

Desirable Characteristics

- Low cost
- Does not need adjacent modules for mechanical support
- Easy installation and removal
- In-place access to test connectors
- Adequate shielding to allow full freedom in module placement
- Minimizes need for transmit and storage protection devices
- Accepts modules of incremental sizes
- Provisions to vary cooling air to each module independently
- Facilitates use of extender modules

Conclusion:

- Need detailed design to proceed any further

and some analog and digital modules will require shielding anyway, the excess cost appears to be minor and may well be offset by a simpler mounting enclosure design.

2.4.3.11 PHYSICAL CHARACTERISTICS – Architecture 3 has projected characteristics as follows:

Volume 8845 cu in (5.1 cu ft) Weight 306 lbs
Number of modules 135

A detailed breakdown is shown in Table 2.4.3.11-1.

2.4.3.11(A) SOFTWARE – Table 2.4.3.11(A)-1 shows the memory assumed to be available, the amount of memory required for instructions, data and working space, and the number of program instructions for the software required to support Architecture No. 3. The software required for the dedicated microcomputers in each module is not included in Table 2.4.3.11(A)-1. The cost of developing this software is assumed for the purposes of economic analysis of the architecture to be included in the development cost of each module. Each different type of functional MFBARS module may be designed by several different vendors. Each vendor would have a different hardware/software trade-off result. One may choose to use extensive computer control and processing, another may use mostly dedicated logic resulting in very little software development for the module. For this reason it does not appear to be meaningful to try to separate out software costs for each module.

Table 2.4.3.11-1. Breakdown of Physical Characteristics, Architecture 3

	VOLUME	WEIGHT	NUMBER OF MODULES
RF Conversion	4480	174	88
Signal Bus	405	19	17
Signal Processor	510	14	14
Bite	30	1	1
Power Supply	1800	36	6
Frequency Reference	120	2	2
Command Bus	200	7	7
Enclosures	1300	53	
Total	8845	306	135

The following assumptions affecting software development costs were made for the purposes of the Phase I study:

a. Routine software development

b. Normal new project with an experienced crew

c. Hardware is developed along with the software

d. Computer time is not a constraint

e. GPS, SEEK TALK and the Wideband Signal Processor software is 25% new design and 100% new coding. All other software is 100% new design and new coding.

2.4.3.12 PERFORMANCE CHARACTERISTICS – Relative to the independent dedicated capability of Architecture 1 the integrated Architecture 3 will suffer some performance degradation in the number of simultaneous signals which can be processed. Assuming no problems with colocated antennas the performance characteristics of Table 2.4.3.12 indicates some degradation from Architecture 1. Specifically the equipment of Architecture 1 would be able to:

Transmit JTIDS, IFF Transponder, IFF Interrogator and TACAN Signals Simultaneously

Transmit HF, VHF-FM, VAF-AM, UHF-AM Signal Simultaneously

Receive 14 signals in the 2 to 400 MHz ILS, Conventional Band Simultaneously

The detailed performance of Architectures 1 and 3 relative to transmit power, sensitivity, etc. would be equal for practical purposes. This is one area where the integrated architecture appears to have an advantage and that is in the ability to provide maximum tolerance to interference. In conventional receiver design the normal procedure is to design AGC in order to maximize the output signal to noise ratio assuming no interference. With the integrated system the AGC system may be design so as to adaptively maximize the signal to noise plus interference.

It appears that the integrated Architecture 3 has better tolerance to failures for a small number of failures. Failure in some modules because of their redundancy have no effect on either capability or simultaneous signal processing. Most modules cause loss of simultaneous signal processing capability if they fail but do not cause loss of capability. In a few modules failure means loss of capability but to no more extent than in a dedicated system.

2.4.3.13 SENSITIVITY ANALYSIS – Architecture 3 is constructed using a total module count of 135 consisting of 39 different designs. Of the 39 different designs there are 13 designs which are used only in one system. These dedicated designs are:

GPS preamplifier
GPS Antenna weighting
GPS PN Modulator
GPS LO Synthesizer

Table 2.4.3.12. Performance Characteristics Architecture 3, 4, 5, 6

GPS	• Receive 4 frequencies while acquiring a 5th and nulling up to 4 jamming signals
JTIDS, IFF, TACAN	• Receive 8 frequencies in any combination and nulling up to 4 jamming signals in JTIDS band • Transmit any one signal
SEEK TALK	• Receiver SEEK TALK signal while nulling up to 4 jamming signals. • Transmit SEEK TALK signal • Transmit or receiver UHF voice type signal when not used for SEEK TALK
ILS	• Receive 3 signals simultaneously
Conventional Voice	• Transmit 1 signal in any band

L Band Antenna Weighting (JTIDS)
Fast Hop Synthesizer (JTIDS)
UHF Antenna Weighting
VHF-AM TX
VHF-FM TX
HF TX
VHF-AM Preamp
VHF-FM Preamp
HF Preamp

It is appropriate to consider what could be done to eliminate these unique modules since the MFBARS concept is based on cost reduction by using common modules throughout the system. There are three ways by which a unique module could be eliminated:

a. Eliminate the system
b. Eliminate the specification which requires the module
c. Combine the function with other modules

Examination of the list shows that four unique designs are envisioned for the GPS system with a total cost of 16.4K per system for the 13 modules required. The remainder of the GPS system employs 34 modules (some of which are time shared with other systems) of 11 designs which are also found in other systems. These designs are:

		Quantity
Variable IF	dedicated to GPS	5
70 MHz IF	dedicated to GPS	5
TDM Coupler		2
BITE	shared with other systems	1
Power Supply	shared with other systems	6
Frequency Reference	shared with other systems	2
NBSP Analog	shared with other systems	2
NBSP Digital 1	shared with other systems	2
NBSP Digital 2	shared with other systems	2
Mass Memory	shared with other systems	6
Micro Comp	shared with other systems	1

It can be seen that 11 of 15 different designs required to construct a GPS set are common to other systems of the MFBARS set and significant cost savings are expected by including this system in the MFBARS set. Other systems show an even greater commonality. Thus it appears that none of the baseline should be dropped from the MFBARS concept.

The list of unique designs can be broken down into three major categories.

a. preamplifiers
b. array element weighting
c. transmitters

Relative to the preamplifiers there are two options; eliminate them thereby reducing the system performance significantly or combine them into other preamplifiers. Only the second opt'on appears palatable and this approach was used in Architecture 6.

A unified design approach to the three antenna weighting modules might be feasible however because of the wide frequency spread is appears that the only other way to reduce their cost would be to eliminate one or more of them. As shown in Table 2.4.3.13-1 the elimination of these requirements would reduce the hardware cost by 22.2K per system which is a 17% reduction.

Also shown in Table 2.4.3.13-1 are the savings associated with reducing the GPS capability to four channels one frequency from the present five channels two frequency and the savings gained by reducing the number of simultaneous L band frequencies from 8 to 4. In evaluating the worth of these performance reductions it is important to remember that in some cases graceful degradation has been adversely affected by these changes.

Elimination of the power amplifiers like preamplifiers has disastrous effects on system performance however the opportunity to combine modules exists and has been exploited in Architecture 6. Architecture 3 also affords the opportunity to eliminate all or portions of the signal distribution bus with flexibility degradation but no performance degradation. This option has been used in Architecture 5 and results in a savings of 5.9K per system.

2.4.3.14 RISK ASSESSMENT – In evaluating the risk associated with any particular architecture it is appropriate to consider two levels of risk; first, does the architecture critically depend on one or more technological advances from which there is no suitable fallback position? If so, then they must be examined very critically since failure to achieve the advances may jeopardize the entire system.

Table 2.4.3.13-1. Cost Savings Possible with Reduced Performance Architecture 3

CAPABILITY REDUCTION	COST SAVINGS
Eliminate Adaptive Antenna Nulling	22.2K per system
Receive only one GPS frequency (4 channels)	7.5K per system
Reduce L Band receive channels to 4 JTIDS - 1 TACAN - 1 IFF - 2	10.5K per system
Eliminate FDM Bus to WBSP	5.9K per system

Secondly, for those which have fallback positions, what is the likelihood of failure to achieve the goal and consequences of being forced to a fallback position? This form of risk is far less severe since it primarily impacts acquisition costs and schedule and not the system itself.

Evaluation of Architecture 3 reveals it to be a very risk-free configuration. In general, most technology required to construct this architecture has already been proven. The only exception to this is in the area of the wideband multipurpose signal processor. Obviously fallback positions exist for this subsystem with the worst case being separate processors for each system. Even though this technology has not yet been proven, GDE expects a high degree of success in its development and any cost risk should be minimal relative to the overall program costs.

The technical risk is evaluated as minimal for Architecture 3. However, because MFBARS is a new concept in system procurement, there exists significant possibility that human influences in the procurement cycle will result in erosion of its potential benefits even to the point where it is forever banished to oblivion.

The MFBARS concept of standard multipurpose modules affords the opportunity to significantly reduce the time and cost required to introduce new system concepts into the inventory. As might be expected capitalizing on the opportunity requires some initial investment.

It has been traditional to specify end to end system performance and leave the detailed specification of the individual functional elements to the contractor. The procurement agency's involvement in the detailed specifications was mainly limited to evaluation of the proposals to ensure that the bidders had an understanding of the problem and capability to provide the solution. In most cases a single contractor was selected who had the best average capability and an acceptable cost. In very few cases did the selected contractor have the best capability in all areas. During the course of the contract the procurement agency would monitor the progress and offer advice in an attempt to ensure success of the program. Seldom was the advice given in the form of a directive nor were formal approved documents issued on functional elements of the system.

In procurement of a MFBARS type system it will be necessary to call upon existing capability within the procurement agency to take an active role in preparing formal specifications for the individual functional elements.

The decision as to what detail to include in the functional specification will have significant impact on the ultimate cost of the MFBARS concept. From the viewpoint of the designer of new systems it would be desirable if all parameters were fully specified so that computer simulation could accurately predict system performance. Such a specification could seriously restrict the area of competition for a new module and drive the cost to be prohibitive. On the other hand the widest area of competition and cost advantage will result from a specification which has the fewest and widest tolerance specifications. Unfortunately, the MFBARS system performance will be compared against the dedicated equipment performance, some of which have had many generations to mature. A functional specification which overlooks or downgrades a critical

parameter could cause erroneous conclusions as to the effectiveness of the MFBARS concept. This decision as to the content of the initial functional specifications is critical to the success of the MFBARS concept and should be approached as shown in Table 2.4.3.14-1. The cycle includes a computer simulation and procurement of a breadboard set of modules whose sole function is to test the adequacy of the specifications. These efforts will tend to offset the maturity advantage that exists in the dedicated specifications.

Throughout this cycle the procurement agency must take an active role to prevent over-specification which unnecessarily limits the technologies which might be used to implement the function.

An important point to remember in procuring these initial modules is the effect that excessive documentation requirements will have on the numbers of bids received. Many of the smaller speciality houses which would be desirable additions to the qualified bidders list may not have personnel, process, quality control, etc., procedures which can withstand close examination and it is unlikely that they would establish these procedures merely to be allowed to bid on a small quantity development. Accordingly, an absolute

Table 2.4.3.14-1. Cycle for Development of Module Specifications

ACTION	BY	BASED ON
General definition of MFBARS module complement interface rules, mechanical configuration	Procurement agency	Results of MFBARS study contracts
Generation of detailed functional specifications	System houses (2)	General definition
Prediction of performance	Computer simulation house	Specification set(s)
Modification of specification set	System house	Deficiencies found by simulation
Approval of BB specification set	Procurement agency	
Procurement of BB module set(s)	Speciality houses	Approved specifications
Bench test of system	System house	Module set
Modification of specifications	System house	Bench test results
Approval of development specification set	Procurement agency	

minimum amount of documentation should be required for modules procured for evaluation and the potential bidders advised as to the type of documentation and procedures which would be required in event of award of a production contract.

Once the bugs in the computer simulation technique and bench test setup are worked out the procurement agency should establish its own capability and disseminate the information on how it is done widely throughout the system house community.

Procurement of the module set should be done by multiple procurements for the same module with the area of competition expanded to include specialty houses. Contracts should be granted for high risk, high payoff approaches as well as low risk approaches. In this manner there will always be a fallback position if the high risk approach fails. After a module has been procured which has satisfactory performance and appears to have potential application in many systems, a module characterization cycle should be implemented during which the detailed performance is measured for each reasonable set of the independent variables. This data would be of significant use to determine the suitability of the module to new applications and would highlight areas of potential problems.

Once the core module set is working, the procurement agency will find they are interfacing with a greatly expanded hardware and software community. A significant increase in unsolicited proposals for new or improved modules is expected as specialty houses see a way to implement their ideas into the system without going through a system house where their profit potential would be significantly diluted. System houses which will be at a competitive disadvantage for the more common modules will redirect their efforts toward more complex modules which will offer improved mission effectiveness. Here again the computer simulation and breadboard test capabilities established during the initial procurement will be a valuable tool in determining the effectiveness of the new module or operational procedure and in insuring backward compatibility.

2.4.3.15 ECONOMIC ANALYSIS – Table 2.4.3.15-1 shows a breakdown of the LCC for Architecture 3.

Table 2.4.3.15-2 is an LCC as computed by the PRICE model. Two major differences are apparent between Tables 2.4.3.15-1 and 2.4.3.15-2. First, GDE considers support equipment and spares costs to be a part of the support costs. Thus, our support costs of \$43.6K are much larger than the \$23.9K shown by PRICE. Secondly, we have added a software cost of about \$10.7K to the overall LCC which is not included in the PRICE printout.

Overall, the cost of this system projects as costing only 66% of the dedicated unique design of Architecture 1. This may be low, however, as the development costs as predicted by PRICE appear to be significantly low considering the magnitude of the systems definition and integration task in a MFBARS approach.

2.4.4 MFBARS ARCHITECTURE NO. 4

Architecture No. 4 is a totally integrated MFBARS configuration. This architecture is intended to have the equivalent functions, capability, and performance of Architectures

Table 2.4.3.15-1. LCC Breakdown

SUBSYSTEM	COST	% OF HARDWARE
Antenna	13.8	10.5%
RF Conversion	70.9	54%
Signal Bus	6.7	5%
Signal Processing	8.3	6.3%
BITE	4.5	3.5%
Power Supply	14.7	11.2%
Frequency Reference	1.9	1.5%
Command Bus	6.9	5.3%
Enclosures	3.2	2.4%
Hardware Total	130.9	100%
Software Total	10.7	
Logistics Total	43.6	
LCC Total	185.2K	per system

No. 1, No. 2, and No. 3. Table 2.4.3-1 lists the functions to be performed by these architectures.

This architecture consists of antennas, receivers, transmitters, signal distribution buses, signal processors, a system controller, and data/control buses as shown in Figure 2.4.4-1. The antennas for this MFBARS configuration are the same as those for Architecture No. 3. Each communications function has dedicated preamplifiers and power amplifiers as in Architecture No. 3. However, in Architecture No. 4 these amplifiers are connected to the multiband receivers and exciters by way of RF buses rather than directly by dedicated cables. This configuration provides more freedom to locate the preamplifiers and power amplifiers close to their associated antennas to eliminate losses in long cable runs or to eliminate a large number of separate cables interconnecting the amplifiers with the receivers and exciters.

This configuration also provides full freedom to share multiband receivers and exciters for any of communication functions. This feature is not possible with Architecture No. 3. The multiband receivers and exciters for Architecture No. 4 are connected to the signal processors by way of a redundant digital bias as shown in Figure 2.4.4-1. The digital bus for Architecture No. 4 must handle the digitized signal data from the receivers to the signal processors and also the digitized data from the signal processors to the multiband exciters. The system controller and data/control bus structure is essentially the same as for Architecture No. 3.

2.4.4.1 ANTENNA CONFIGURATION – See Section 2.4.3.1.

Table 2.4.3.15-2. Price Life Cycle Cost for Architecture No. 3

SYSTEM TOTALS PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
Equipment	17,718	108,754	0	126,472
Support Equipment	0	9,301	9,301	18,602
Manpower	0	0	5,117	5,117
Supply	0	15,039	9,048	24,087
Supply Adm.	0	38	378	416
Contractor Support	0	0	0	0
Other	0	0	133	133
Total Cost	17,718	133,132	23,977	174,827
Additional Cost				
Grand Total				
	$1000	%		
Equipment Development	17,718	10		
Equipment Production	108,754	62		
Support Total	43,355	28		
	174,827			

2.4.4.2 RF CONVERSION – Table 2.4.4.2-1 lists the major characteristics of the module set developed in Architectures No. 3, 4, and 5. This module set isolates functions down to the smallest practical increment which has stand-alone utility and at the same time does not allow the overhead costs (BITE, power supply isolation, command interface) to become excessive. Because of this small module, the module set offers the maximum in user flexibility relative to addition or deletion of specific functions or redundancy. Table 2.4.4.2-2 describes some of the more important characteristics of the module set.

2.4.4.3 WIDEBAND PROCESSOR – See Section 2.4.3.3.

2.4.4.4 NARROWBAND SIGNAL PROCESSORS – See Section 2.4.3.4.

2.4.4.5 INTERNAL SIGNAL/DATA DISTRIBUTION – Architecture No. 4 features five separate redundant buses as described in Table 2.4.4.5-1. Receive and transmit FDM buses at the antenna frequencies are used to provide maximum freedom in physical

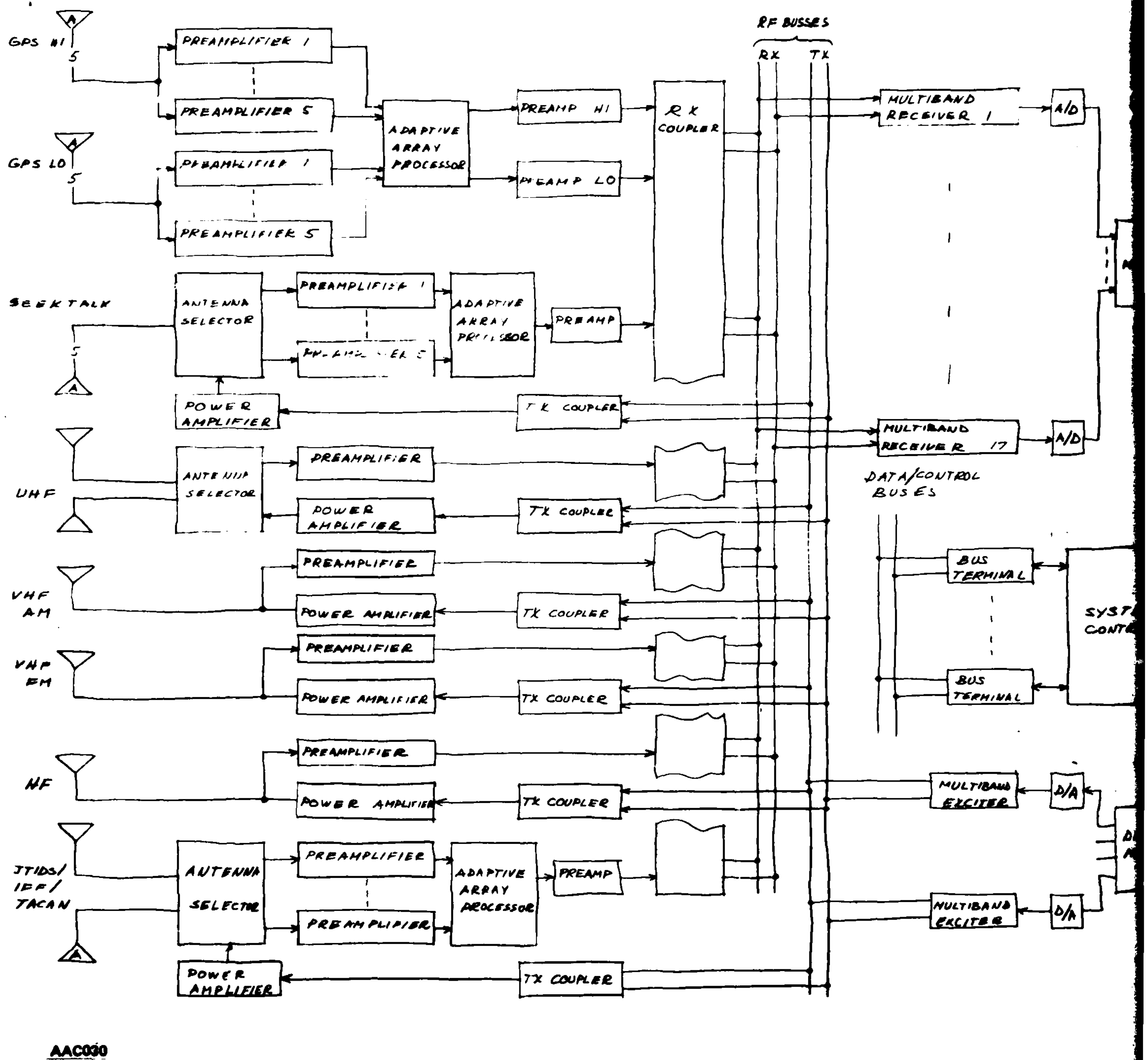

RF BUSSES
RX
TX
GPS #1
GPS LO
SEEKTALK
UHF
VHF AM
VHF FM
HF
JTIDS/ IFF/ TACAN
PREAMPLIFIER 1
PREAMPLIFIER 5
ADAPTIVE ARRAY PROCESSOR
PREAMP HI
PREAMP LO
RX COUPLER
ANTENNA SELECTOR
PREAMP
POWER AMPLIFIER
TX COUPLER
PREAMPLIFIER
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 17
A/D
DATA/CONTROL BUSES
BUS TERMINAL
MULTIBAND EXCITER
D/A
AAC030

Figure 2

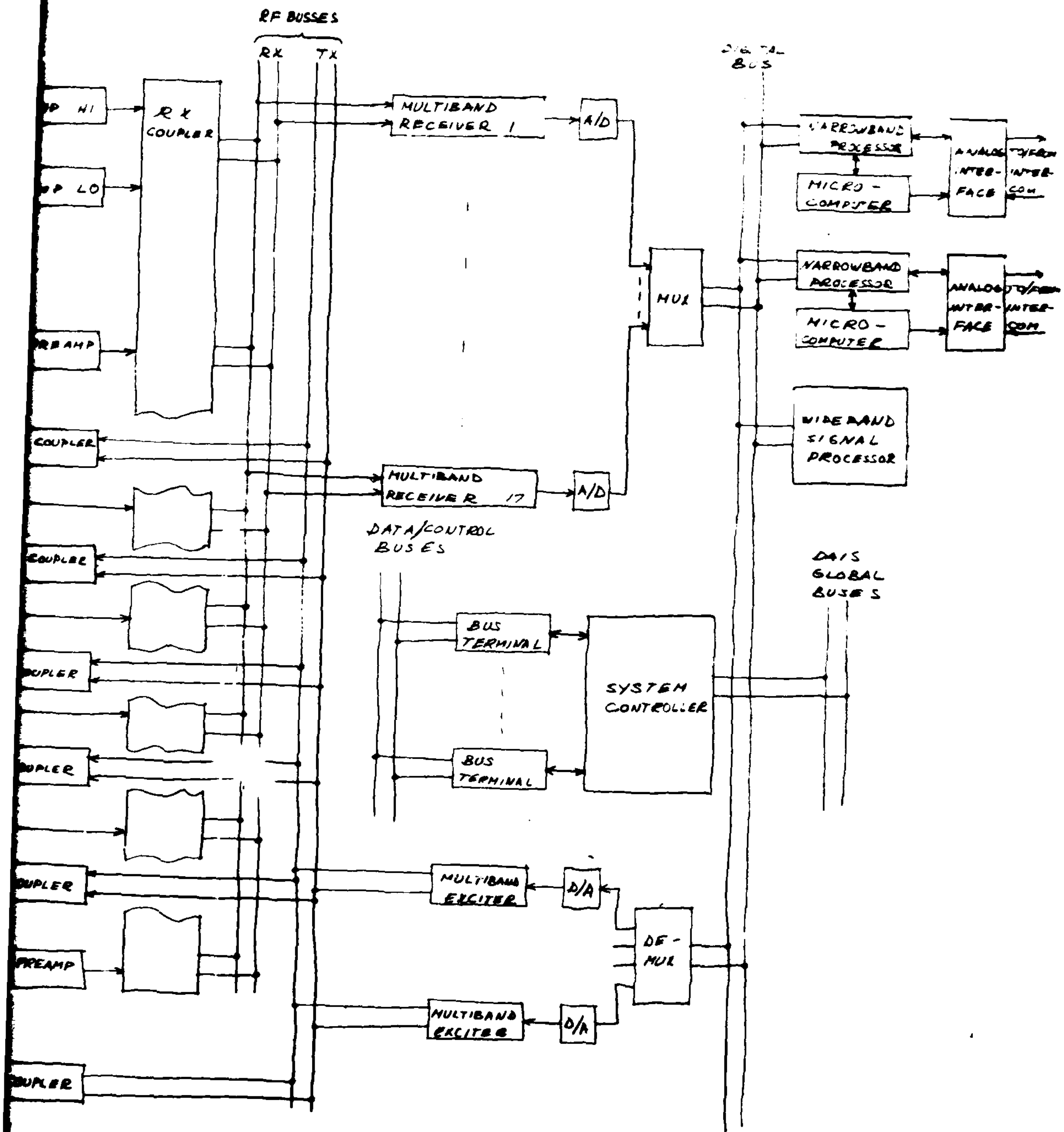


Figure 2.4.4-1. MFBARS Architecture
No. 4

2

Table 2.4.4.2-1. Architectures No. 3, 4, and 5, RF Conversion

- Employs smallest practical module size – Further decrease will cause module overhead costs (BITE, power supply, control, housing, etc.) to be an excessive percentage of total cost.
- Small modules allow maximum flexibility in physical location.
- Uses 88 modules of 23 different types, including some multipurpose modules:
    - A broadband downconverter/IF with switched IF/BW
    - A downconverter/IF with 70 MHz CF/switched BW/switched LIN/LOG transfer function
    - A multiband exciter 70 MHz input/antenna frequency output
    - A power amplifier covering all JTIDS, IFF, TACAN requirements
    - A slow hop synthesizer covering all LO requirements for 2-400 MHz and IFF, TACAN equipments
- Provides for time-sharing of the L-band transmit capability of a fast rate ($<20\mu S$)
- Provides for time-sharing of other modules at a slow rate
    - 5 receiver channels serve both GPS frequencies
    - 4 receiver channels switch between IFF/TACAN and JTIDS when JTIDS acquisition is required
    - 3 receiver channels serve all HF, VHF-FM, VHF-AM, UHF-AM, ILS receive functions
    - 1 exciter channel serves all HF, VHF-FM, VHF-AM, UHF-AM power amplifiers

Table 2.4.4.2-2. RF Conversion, Architectures No. 3, 4, 5

NO.	MODULE NAME	QTY.	COST	WT.	VOL. CU. IN.	PWR.
1	GPS Preamp	5	$ 1,960	5.0	150	5
2	GPS Weighting	2	10,400	16.0	420	20
3	GPS PN Mod.	5	3,300	6.3	150	15
4	Var IF	17	8,800	25.5	510	51
5	70 MHz IF	17	8,400	25.5	510	68
6	GPS L.O.	1	750	1.0	30	6
7	L-Band Preamp Wide	4	1,350	4.0	120	16
8	L-Band Preamp Narrow	4	1,850	4.0	120	16
9	L-Band Weighting	1	5,500	12.0	360	15
10	Fast Hop Synthesizer	2	2,350	4.0	120	20
11	Slow Hop Synthesizer	10	7,650	20.0	600	40
12	Ant. Select	1	600	1.0	30	2
14	L-Band TX	1	3,600	9.0	240	90
15	UHF Pre-Tune	5	2,700	6.2	150	15
16	UHF Weighting	1	6,300	8.0	210	10
17	UHF TX	2	2,650	4.0	300	24
18	Multiband Exc.	3	2,600	4.5	90	18
19	VHF-AM TX	1	1,800	4.0	150	10
20	VHF-FM TX	1	1,700	3.0	120	8
21	HF TX	1	1,900	6.0	180	80
22	VHF-AM Preamp	2	1,600	2.5	60	6
23	VHF-FM Preamp	1	950	1.2	30	3
24	HF Preamp	1	1,000	1.3	30	4
23 Diff.		88 Total	$79,710 Total Cost	174.0	4,680 cu. in.	542 Watts

Table 2.4.4.5-1. Internal Signal/Data Distribution, Architecture No. 4

Four Busses: • FDM at antenna frequency; one receive bus, one transmit bus • Digital signal bus generated by sample and hold at 70 MHz followed by A/D conversion • General purpose command/data bus • High-speed command bus for time critical commands Each module addressed directly from central processor.

placement of RF preamplifiers and power amplifiers. This form of bus has been shown to be more expensive than the other architectures and in the case of the receive system it has definite performance degradation. At the output of the preamplifier, the signal has not yet been fully normalized by AGC action nor have they been band limited to the extent performed later on in the receiver. Thus, there is significantly more chance of cross-channel interference and sensitivity degradation. Also, the losses associated with the coupling process require the addition of more gain prior to coupling to prevent loss of sensitivity. This additional gain makes the front end more susceptible to saturation on a strong signal.

A second significant feature of this configuration is the use of a digital signal bus. Both the wideband and the narrowband signal processor perform their signal processing after converting the analog signal to a digital signal using a sample and hold and A-to-D converter. In this architecture the circuitry which generated the digital signal is mounted with the IF and a digital signal bus is formed to transmit the signals for processing.

2.4.4.6 CONTROL STRUCTURE – The control structure for Architecture No. 4 is the same as that for Architecture No. 3. The control software will be slightly different because of the added flexibility in assigning functional module resources due to the use of the RF and digital buses but this difference should not significantly affect even the software costs.

2.4.4.7 EXTERNAL SIGNAL/DATA INTERFACES – The external signal/data interfaces for Architecture No. 4 are the same as those described for Architecture No. 3 in Section 2.4.3.7.

2.4.4.8 ELECTRICAL POWER CONVERSION CONTROL AND DISTRIBUTION – A common form of electrical power subsystem has been used for all integrated Architectures No. 3, 4, 5, 6, and 7. Table 2.4.4.8-1 summarizes the more important characteristics of the proposed architecture. While the basic concept was developed

Table 2.4.4.8-1. Electrical Power Conversion, Control, and Distribution

- All integrated Architectures No. 3, 4, 5, 6, 7 identical.
- Features:

  Stand-alone converter with family of coarsely regulated voltages

  Easy addition of more capacity by paralleling modules

  Automatic adjustment for changes in load distribution

  Fire regulation, isolation, control in each user module

  Unique stand-alone converters for unique requirements

using Reference 1 as a starting point, it has features which encourage but do not require users to employ a family of standard voltages. Furthermore, it addresses the problem of bus protection, load control, load sharing, and distribution line drop and EMI pickup which were not fully considered in Reference 1 since some of these problems are unique to a MFBARS approach.

2.4.4.10 PACKAGING CONCEPT – Schedule and funding limitations have prevented a complete evolution of a packaging concept, however, some preliminary conclusions and desirable characteristics are contained in Table 2.4.4.10-1. The Hughes packaging concept[1] is a good starting point for the final package, however, it appears that some modifications may be desirable to retain full flexibility of the MFBARS approach. With MFBARS the module set within an enclosure will be user specified and, therefore, there is no a priori knowledge of the mux between analog, digital, and RF modules, the heat dissipated by neighboring modules or the EMI problem between neighboring modules. Because of this it appears desirable to develop a single EMI shielded package which is suitable for all types of circuitry. Such a conclusion appears to result in unnecessary costs to digital and analog modules, however, since 75 to 80% of the module set is RF and some analog and digital modules will require shielding anyway, the excess cost appears to be minor and may well be offset by a simpler mounting enclosure design.

2.4.4.11 PHYSICAL CHARACTERISTICS – Architecture No. 4 has projected characteristics as follows:

Volume	8,890 cu. in. (5.1 cu. ft.)
Weight	308 lbs.
Number of modules	133

A detailed breakdown is shown in Table 2.4.4.11-1.

Reference 1 AFAL Technical Report AFAL-TR-78-59, Feb. 78

[1] Draper Lab. Report, Apr. 78, Vol. 1, "GPS/JTIDS/IFF Integration Study"

Table 2.4.4.10-1. Packaging Concept, Architecture Nos. 3, 4, 5, 6, and 7

Preliminary Results:
Specify only mechanical and electrical interface
Minimum module size approximately 5 x 6 x 1 inches
Desirable Characteristics:
Low cost
Does not need adjacent modules for mechanical support
Easy installation and removal
In place access to test connectors
Adequate shielding to allow full freedom in module placement minimizes need for transit and storage protection devices
Accepts modules of incremental sizes
Provisions to vary cooling air to each module independently
Facilitates use of extender modules
Conclusion:
Need detailed design to proceed any further

Table 2.4.4.11-1. Breakdown of Physical Characteristics, Architecture No. 4

	VOLUME	WEIGHT	NO. OF MODULES
RF Conversion	4,480	174	88
Signal Bus	450	21	15
Signal Processor	510	14	14
BITE	30	1	1
Power Supply	1,800	36	6
Frequency Reference	120	2	2
Command Bus	200	7	7
Enclosures	1,300	53	
Total	8,890	308	133

2.4.4.11(A) SOFTWARE – The software for Architecture No. 4 is the same as that described for Architecture No. 3 in Section 2.4.3.11(A).

2.4.4.12 PERFORMANCE CHARACTERISTIC – The performance characteristics and capability of Architecture No. 4 is identical to that of Architecture No. 3 except that Architecture No. 4 is more subject to overload by a strong signal. In Architecture No. 4 a bus was implemented at the RF frequency. This requires the addition of front end gain prior to coupling onto the bus in order to preserve good receiver noise figure. Since the signals have not been normalized or fully band limited prior to this bus, there exists a significant possibility of cross coupling or overload.

2.4.4.13 SENSITIVITY ANALYSIS – Architecture No. 4 was configured using the module set of Architecture No. 3 plus the additional modules required to implement a FDM bus at the antenna frequency. It employs the same set of 13 dedicated designs of Architecture No. 3 plus four additional dedicated designs associated with the RF bus. In general, the same option to eliminate, modify, or combine modules exists as was described in paragraph 2.4.3.13.

2.4.4.14 RISK ASSESSMENT – Architecture No. 4 is constructed using the modular building blocks of Architecture No. 3 plus those modules required to implement an RF bus. It is obvious, therefore, that the risk of Architecture No. 4 is the same as Architecture No. 3 as described in paragraph 2.4.3.14 plus the additional risk associated with the new modules. It is apparent that some risk is associated with coupling several signals which are not normalizer or band limited onto a common bus, however, an obvious fallback position exists in that the bus can be eliminated and replaced with point-to-point cables as is done in Architecture No.3.

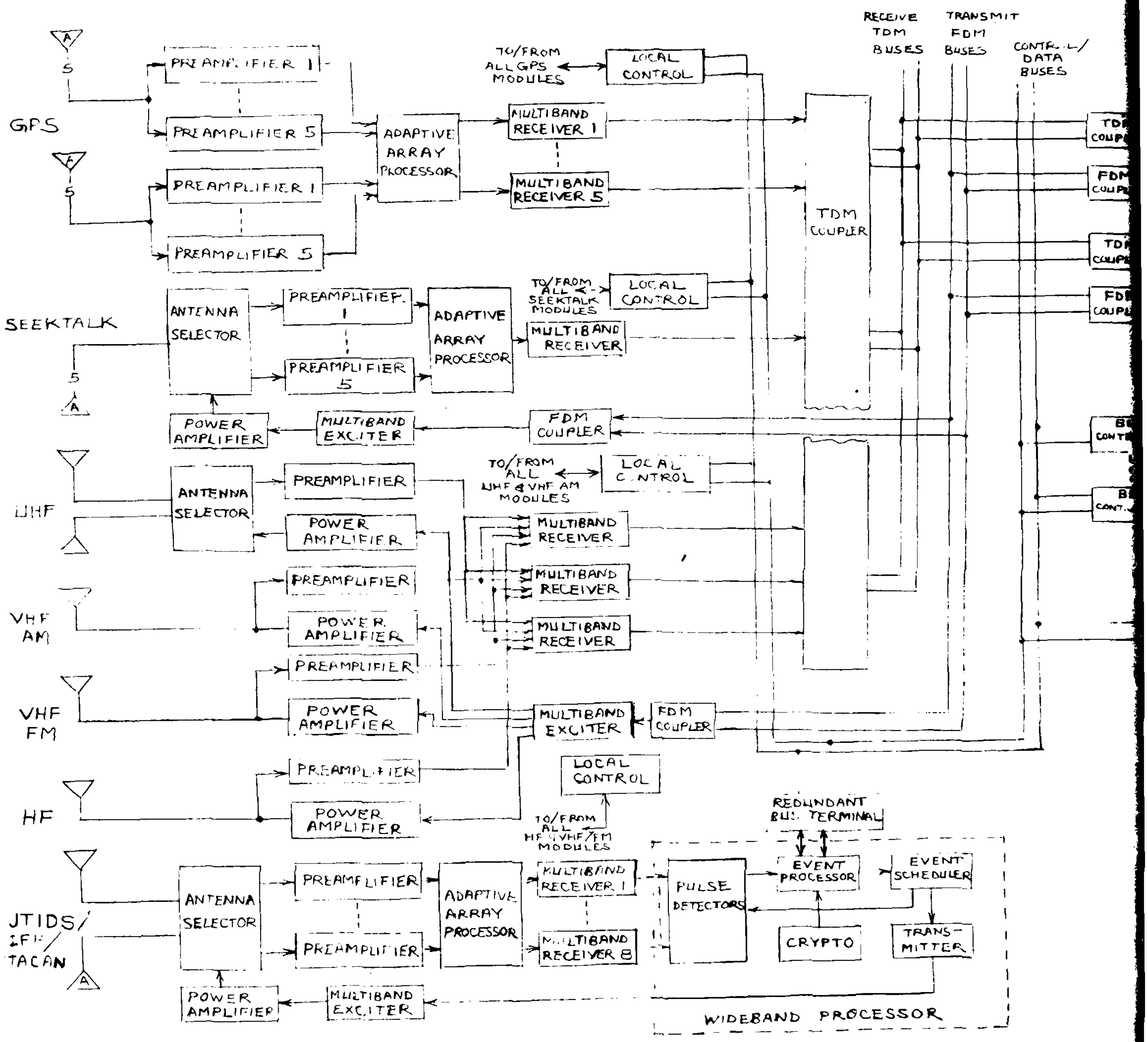
2.4.4.15 ECONOMIC ANALYSIS – Table 2.4.4.15-1 shows a breakdown of the LCC for Architecture No. 4.

Relative to Architecture No. 3 there is an increase in the signal bus costs as reflected by the more difficult busing at the RF frequency. The slight decrease in the overall module count for this configuration causes a corresponding slight decrease in the cost of the BITE, power supply, and command subsystem. Overall the cost of this architecture is about 2.1% larger than Architecture No. 3.

2.4.5 MFBARS ARCHITECTURE NO.5

Architecture No. 5 is a totally integrated MFBARS configuration. This architecture is intended to have the equivalent functions capability and performance of Architecture No. 1 through No. 4. Table 2.4.3-1 lists the functions to be performed by these architectures.

This architecture consists of antennas, receivers, transmitters, signal distribution buses, signal processors, a distributed control configuration and data/control buses as shown in Figure 2.4.5-1. As in previous integrated architectures, each communications function has dedicated preamplifiers and power amplifiers as in Architecture No. 3. This architecture is different from those previously described because of the elimination of



GPS
PREAMPLIFIER 1
PREAMPLIFIER 5
PREAMPLIFIER 1
PREAMPLIFIER 5
ADAPTIVE ARRAY PROCESSOR
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 5
TO/FROM ALL GPS MODULES
LOCAL CONTROL
RECEIVE TDM BUSES
TRANSMIT FDM BUSES
TDM COUPLER
SEEKTALK
ANTENNA SELECTOR
PREAMPLIFIER 1
PREAMPLIFIER 5
ADAPTIVE ARRAY PROCESSOR
TO/FROM ALL SEEKTALK MODULES
LOCAL CONTROL
MULTIBAND RECEIVER
POWER AMPLIFIER
MULTIBAND EXCITER
FDM COUPLER
UHF
ANTENNA SELECTOR
PREAMPLIFIER
POWER AMPLIFIER
TO/FROM ALL UHF & VHF AM MODULES
LOCAL CONTROL
MULTIBAND RECEIVER
MULTIBAND RECEIVER
MULTIBAND RECEIVER
VHF AM
PREAMPLIFIER
POWER AMPLIFIER
VHF FM
PREAMPLIFIER
POWER AMPLIFIER
MULTIBAND EXCITER
FDM COUPLER
HF
PREAMPLIFIER
POWER AMPLIFIER
LOCAL CONTROL
TO/FROM ALL HF & VHF/FM MODULES
REDUNDANT BUS TERMINAL
JTIDS/ IFF/ TACAN
ANTENNA SELECTOR
PREAMPLIFIER
PREAMPLIFIER
ADAPTIVE ARRAY PROCESSOR
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 8
PULSE DETECTORS
EVENT PROCESSOR
EVENT SCHEDULER
CRYPTO
TRANS-MITTER
POWER AMPLIFIER
MULTIBAND EXCITER
WIDEBAND PROCESSOR

AAC031

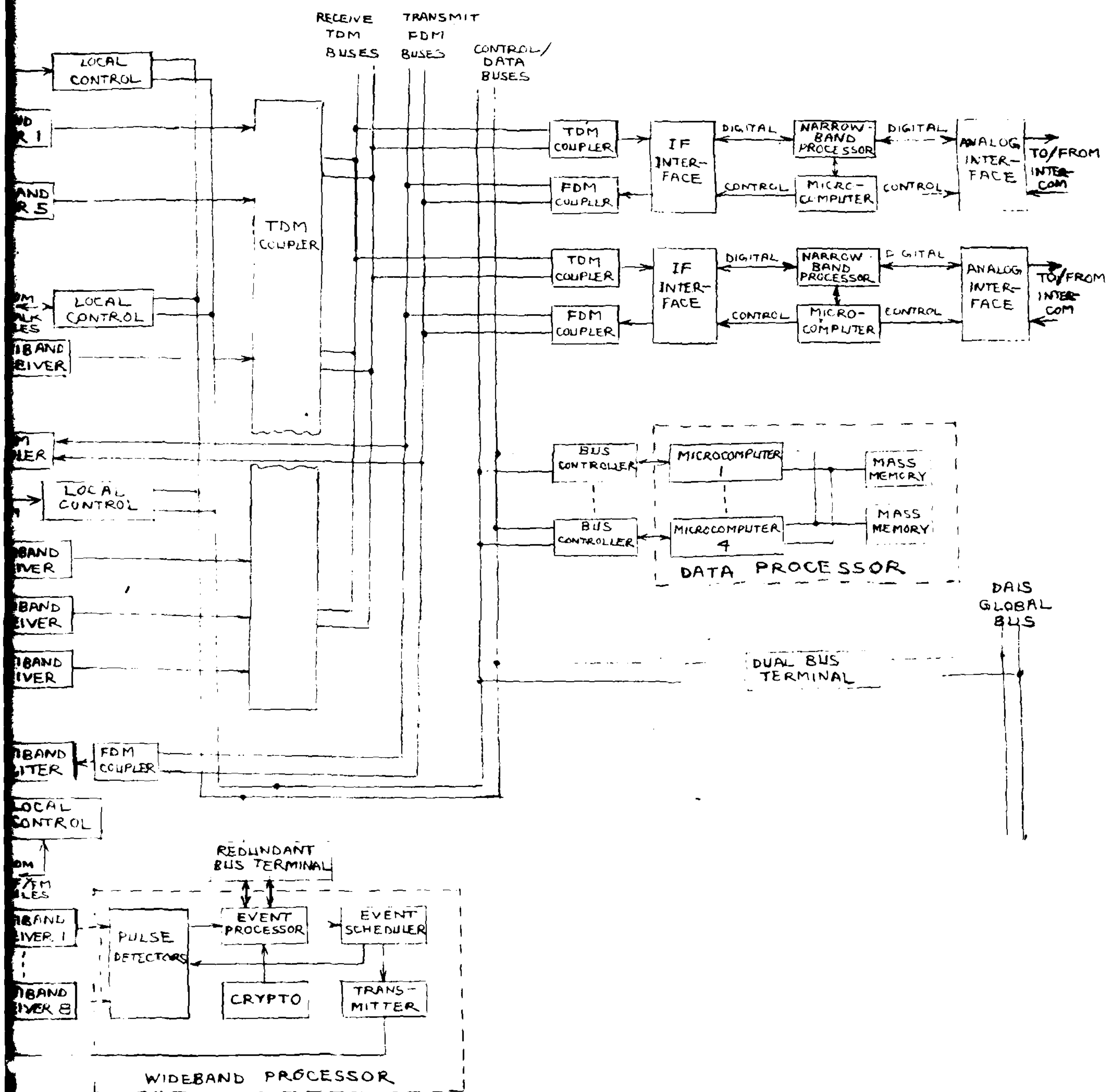


Figure 2.4.5-1. MFBARS Architecture No. 5

Table 2.4.4.15-1. LCC Breakdown

SUBSYSTEM	COST ($K)	% OF HARDWARE
Antenna	13.8	10.4
RF Conversion	70.9	54.0
Signal Bus	8.8	6.7
Signal Processing	8.3	6.2
BITE	4.4	3.3
Power Supply	14.6	11.2
Frequency Reference	1.9	1.4
Command Bus	6.8	5.2
Enclosures	3.2	2.4
Hardware Total	132.7	
Software Total	10.7	
Logistics Total	45.8	
LCC Total	$189.2	Per System

the frequency division multiplexing (FDM) on the receive signal buses. This change eliminates several expensive FDM bus couplers.

Another difference is the distributed location of the system controller functions. This architecture will reduce both the amount of message traffic on the control/data bus but also the number of terminals required on the bus.

2.4.5.1 ANTENNA CONFIGURATION – See Section 2.4.3.1.

2.4.5.2 RF CONVERSION – Table 2.4.5.2-1 lists the major characteristics of the module set developed in Architecture 3, 4 and 5. This module set isolates functions down to the smallest practical increment which has stand-alone utility and at the same time does not allow the overhead costs (BITE, power supply isolation, and command interface) to become excessive. Because of the small module size the module set offers the maximum in user flexibility relative to addition or deletion of specific functions or redundancy. Table 2.4.5.2-2 describes some of the more important characteristics of the module set.

Table 2.4.5.2-1. Architecture 3, 4 and 5, RF Conversion

- Employs smallest practical module size – Further decrease will cause module overhead costs (BITE, power supply; control, housing, etc.) to be an excessive percentage of total cost

- Small modules allow maximum flexibility in physical location

- Uses 88 modules of 23 different types including some multipurpose modules:
    - a broadband downconverter/IF with switched CF/BW
    - a downconverter/IF with 70 MHz CF/switched BW/switched LIN/LOG transfer function
    - a multiband exciter 70 MHz input/antenna frequency output
    - a power amplifier covering all JTIDS, IFF, TACAN requirements
    - a slow hop synthesizer covering all LO requirements for 2-400 MHz and IFF, TACAN equipments

- Provides for time sharing of the L-Band transmit capability at a fast rate ($< 20 \mu s$)

- Provides for time sharing of other modules at a slow rate
    - 5 receiver channels serve both GPS frequencies
    - 4 receiver channels switch between IFF/TACAN and JTIDS when JTIDS acquisition is required
    - 3 receiver channels serve all HF, VHF-FM, VHF-AM, UHF-AM, ILS receive functions
    - 1 exciter channel serves all HF, VHF-FM, VHF-AM, UHF-AM power amplifiers

Table 2.4.5.2-2. RF Conversion, Architecture Nos. 3, 4, 5

NO.	MODULE NAME	QTY.	COST	WT.	VOL. CU. IN.	PWR.
1	GPS Preamp	5	1,960	5.0	150	5
2	GPS Weighting	2	10,400	16.0	420	20
3	GPS PN Mod	5	3,300	6.3	150	15
4	Var IF	17	8,800	25.5	510	51
5	70 MHz IF	17	8,400	25.5	510	68
6	GPS LO	1	750	1.0	30	6
7	L-Band Preamp Wide	4	1,350	4.0	120	16
8	L-Band Preamp Narrow	4	1,850	4.0	120	16
9	L-Band Weighting	1	5,500	12.0	360	15
10	Fast Hop Synthe-sizer	2	2,350	4.0	120	20
11	Slow Hop Synthe-sizer	10	7,650	20.0	600	40
12	Ant. Select	1	600	1.0	30	2
14	L-Band TX	1	3,600	9.0	240	90
15	UHF Pre Tune	5	2,700	6.2	150	15
16	UHF Weighting	1	6,300	8.0	210	10
17	UHF TX	2	2,650	4.0	300	24
18	Multiband Exc.	3	2,600	4.5	90	18
19	VHF AM TX	1	1,800	4.0	150	10
20	VHF FM TX	1	1,700	3.0	120	8
21	HF TX	1	1,900	6.0	180	80
22	VHF AM Preamp	2	1,600	2.5	60	6
23	VHF FM Preamp	1	950	1.2	30	3
24	HF FM Preamp	1	1,000	1.3	30	4
23 Dif-ferent	Total	88 Total	79,710 Cost	174.0 cu. in.	4680 watts	542

2.4.5.3 WIDEBAND PROCESSOR – See Section 2.4.3.3

2.4.5.4 NARROWBAND SIGNAL PROCESSOR – See Section 2.4.3.4

2.4.5.5 INTERNAL SIGNAL AND DATA DISTRIBUTION – The important characteristics of Architecture 5 buses are shown in Table 2.4.5.5-1. In this architecture an attempt was made to reduce bus costs by eliminating the wideband FDM receive bus

Table 2.4.5.5-1. Internal Signal/Data Distribution Architecture 5

Four Buses:
TDM receive bus for narrowband signals
FDM transmit bus by conversion to UHF
Hierarchical general-purpose command bus
Central processor addresses enclosure command modules which in turn address all modules in that enclosure
Hierarchical high speed command bus

since there is no requirement to provide total connectivity between all IF outputs and all signal processor inputs.

A second significant uniqueness of this architecture involves the use of a hierarchical command data bus. While the command bus architecture does not appear to be a major driver there is a significant trade-off involved in structuring these buses. Simply stated, the problem involves deciding how many levels of command should be incorportated into the system. At one end of the problem is a structure where a single command subassembly addresses each module directly. Such a system provides the simplest interconnect structure, however, the speed and complexity required grow without limit as the module set grows. At the other end of the problem is a multilevel hierarchical command structure where each command unit is responsible for a limited number of modules. This architecture allows parallel processing of commands to the module set but does not accommodate additions to the module set as easily.

2.4.5.6 CONTROL STRUCTURE – Architecture No. 5 utilizes a hierarchical form of control structure. A data processor serves as an overall MFBARS manager. Most control commands received via DAIS are sent directly to one or more local controllers for execution. Provision is made under control of the data processor for intercommunication between local control units for cooperation in executing control commands. This configuration subdivides and modularizes the control functions which can lower the risk in software development. Less data bus traffic and fewer bus terminals can simplify the control structure design.

Each individual module would have a microcomputer in this architecture resulting in three levels of control within the MFBARS.

2.4.5.7 EXTERNAL SIGNAL/DATA INTERFACES – The external signal/data interfaces for Architecture No. 5 are the same as those described for Architecture No. 3 in Section 2.4.3.7.

2.4.5.8 ELECTRICAL POWER CONVERSION CONTROL AND DISTRIBUTION – A common form of electrical power subsystem has been used for all integrated Architectures 3, 4, 5, 6 and 7. Table 2.4.5.8-1 summarizes the more important characteristics of the proposed architecture. While the basic concept was developed using Reference 1 as a starting point it has features which encourage but does not require users to employ a family of standard voltages. Furthermore it addresses the problems of bus protection, load control, load sharing and distribution line drop and EMI pickup which were not fully considered in Reference 1 since some of these problems are unique to a MFBARS approach.

2.4.5.10 PACKAGING CONCEPT – Schedule and funding limitations have prevented a complete evolution of a packaging concept; however, some preliminary conclusions and desirable characteristics are contained in Table 2.4.5.10-1. The Hughes packaging concept (Reference 2) is a good starting point for the final package however it appears that some modifications may be desirable to retain full flexibility of the MFBARS approach. With MFBARS the module set within an enclosure will be user specified and therefore there is no apriori knowledge of the mix between analog, digital and RF modules, the heat dissipated by neighboring modules or the EMI problem between neighboring modules. Because of this it appears desirable to develop a single EMI shielded package which is suitable for all types of circuitry. Such a conclusion appears to result in unnecessary costs to digital and analog modules, however, since 75 to 80% of the module set is RF and some analog and digital modules will require shielding anyway, the excess cost appears to be minor and may well be offset by a simpler mounting enclosure design.

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[1] AFAL Technical Report AFAL-TR-78-59 Feb 78

[2] Draper Lab. Report April 78 Vol. 1 "GPS/JTIDS/IFF Integration Study".

Table 2.4.5.8-1. Electrical Power Conversion, Control and Distribution

- All integrated Achitecture 3, 4, 5, 6, 7 identical
- Features
  - Stand-alone converter with family of coarsely regulated voltages
  - Easy addition of more capacity by paralleling modules
  - Automatic adjustment for changes in load distribution
  - Fine regulation, isolation, control in each user module
  - Unique stand-alone converters for unique requirements

Table 2.4.5.10-1. Packaging Concept, Architectures 3, 4, 5, 6, 7

Preliminary Results
Specify only mechanical and electrical interface
Minimum module size approximately 5 x 6 x 1 inches
Desirable Characteristics
Low cost
Does not need adjacent modules for mechanical support
Easy installation and removal
In-place access to test connectors
Adequate shielding to allow full freedom in module placement minimizes need for transit and storage protective devices accepts modules of incremental sizes
Provisions to vary cooling air to each module independently
Facilitates use of extender modules
Conclusion
Need detailed design to proceed any further

2.4.5.11 PHYSICAL CHARACTERISTICS – Architecture 5 has projected characteristics as follows:

Volume	8515 cu. in. (4.9 cu. ft.)
Weight	294 lbs
Number of Modules	126

A detailed breakdown is shown in Table 2.4.5.11-1

2.4.5.11(A) SOFTWARE – The software for Architecture No. 5 is assumed to be the same as that described for Architecture No. 3 in Section 2.4.3.11(A). The different control structures for Architecture No. 3 and No. 5 appear to have an insignificant impact on the amount of software development.

Table 2.4.5.11-1. Breakdown of Physical Characteristics, Architecture 5

	VOLUME	WEIGHT	NUMBER OF MODULES
RF Conversion	4,480	174	88
Signal Bus	75	7	8
Signal Processor	510	14	14
BITE	30	1	1
Power Supply	1,800	36	6
Frequency Reference	120	2	2
Command Bus	200	7	7
Enclosures	1,300	53	
Total	8,515	294	126

2.4.5.12 PERFORMANCE CHARACTERISTICS – The performance characteristics of Architecture 5 are slightly better than that of Architecture 3. This is because Architecture 5 has eliminated the FDM bus. This results in receiver channels which are less susceptible to crosstalk between channels and a transmit signal which exhibits a lower noise pedestal. Other aspects of the performance characteristics and signal handling capabilities are essentially identical to Architecture 3.

2.4.5.13 SENSITIVITY ANALYSIS – Architecture 5 is essentially the same as Architecture 3 except portions of the FDM signal bus have been eliminated and the command subsystem has been restructured to a hierarchical approach. The performance/cost trade-offs which were applicable to Architecture 3 are also applicable to Architecture 5. The number of modules used in Architecture 5 has been reduced to 126 however the number of different designs remains at 39, the same as for Architecture 3.

2.4.5.14 RISK ASSESSMENT – The risk of Architecture 5 is less than that of Architecture 3 as described in paragraph 2.4.3.14 since the wideband FDM bus has been eliminated and along with it a source of potential cross coupling of signals.

2.4.5.15 ECONOMIC ANALYSIS – Table 2.4.5.15-1 shows a breakdown of the LCC for Architecture 5.

This architecture projects as costing 3.8% less than Architecture 3. The major source of this saving occurs in the signal bus subsystem where the FDM bus was eliminated but the TDM bus retained. The reduction in module count reflects minor improvement in the BITE, power supply, and command bus costs.

Table 2.4.5.15-1. LCC Breakdown

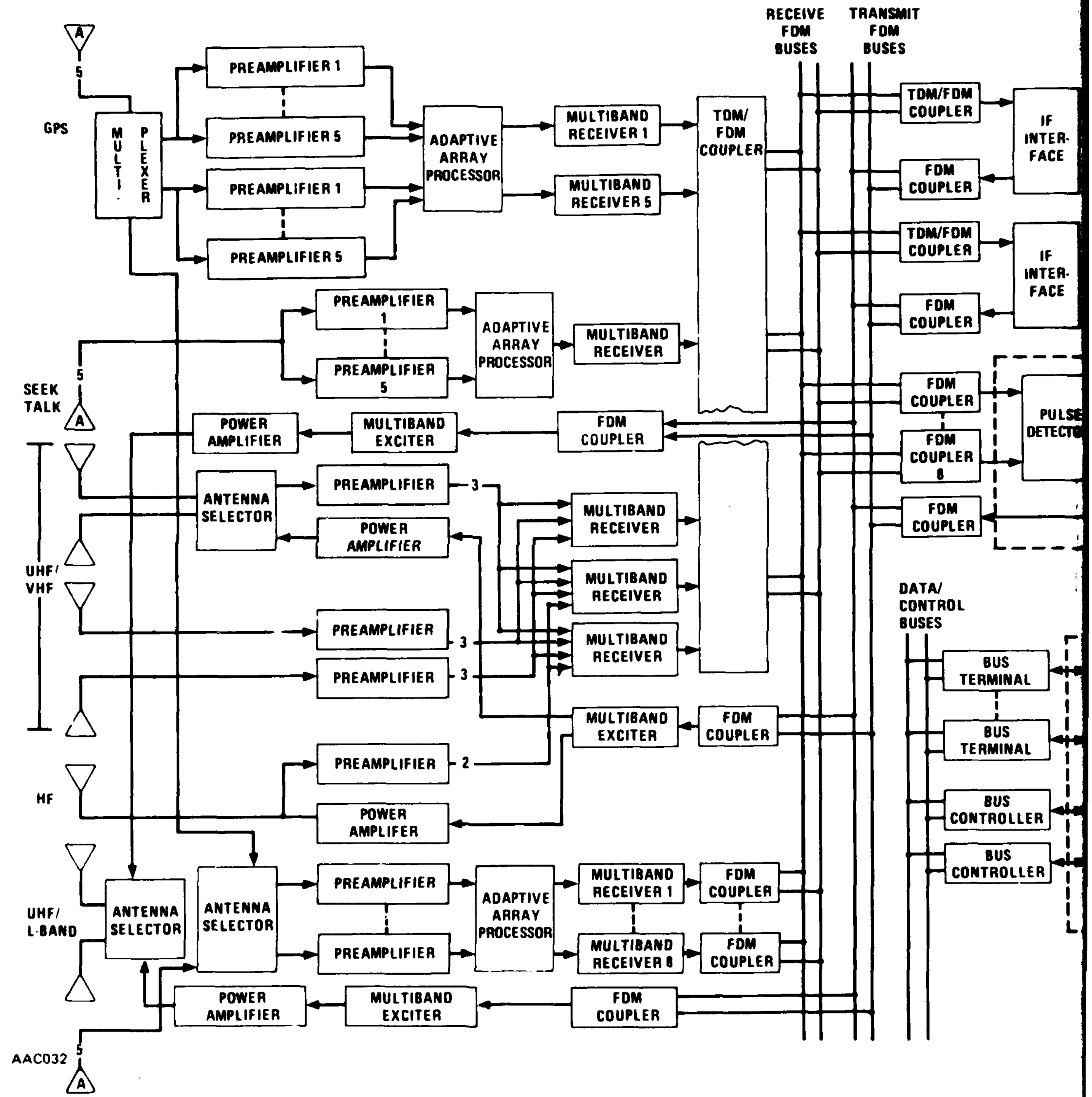
SUBSYSTEM	COST	% OF HARDWARE
Antenna	13.8	10.6%
RF Conversion	70.9	57.0%
Signal Bus	0.8	0.6%
Signal Processing	8.3	6.7%
BITE	4.3	3.5%
Power Supply	14.3	11.0%
Frequency Reference	1.9	1.5%
Command Bus	6.6	5.3%
Enclosure	3.2	2.6%
Hardware Total	124.1	
Software Total	10.7	
Logistics Total	43.3	
LCC Total	178.1K	Per System

2.4.6 MFBARS ARCHITECTURE NO. 6

Architecture No. 6 is a totally integrated MFBARS configuration. This architecture is intended to have the equivalent functions, capability and performance of Architecture No. 1 through No. 5. Table 2.4.3-1 lists the functions to be performed by these architectures.

This architecture consists of antennas, receivers, transmitters, signal distribution buses, signal processors, a system controller and data/control buses as shown in Figure 2.4.6-1. This architecture is similar to Architecture No. 3. The difference is in the antenna/RF conversion partitioning. Antennas are used for either receive or transmit and not for both simultaneously. This eliminates diplexers which tend to degrade receive performance during transmission on the same antenna. Isolation between the antenna used for transmission and the one used for reception is obtained by the physical distance between the antennas. This is discussed further in Section 2.4.6.1.

2.4.6.1 ANTENNA CONFIGURATION – A significantly different antenna configuration for MFBARS Architecture number 6 is used. As described before a single GPS adaptive array is used. Both SEEK TALK and JTIDS adaptive antennas are single bottom fuselage installations. In addition a combination UHF/L-band blade antenna is used for transmission only, one top fuselage and one on the bottom fuselage. The major change is the use of two each VHF/UHF combination antennas on the top and bottom fuselage. This accommodates the requirement to receive 3 simultaneous signals at UHF frequencies and circumvents the need for multiplexer development, considered a difficult task.


RECEIVE FDM BUSES
TRANSMIT FDM BUSES
GPS
MULTI-PLEXER
PREAMPLIFIER 1
PREAMPLIFIER 5
PREAMPLIFIER 1
PREAMPLIFIER 5
ADAPTIVE ARRAY PROCESSOR
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 5
TDM/FDM COUPLER
TDM/FDM COUPLER
FDM COUPLER
IF INTER-FACE
TDM/FDM COUPLER
FDM COUPLER
IF INTER-FACE
PREAMPLIFIER 1
PREAMPLIFIER 5
ADAPTIVE ARRAY PROCESSOR
MULTIBAND RECEIVER
SEEK TALK
FDM COUPLER
FDM COUPLER 8
FDM COUPLER
PULSE DETECTO
POWER AMPLIFIER
MULTIBAND EXCITER
FDM COUPLER
ANTENNA SELECTOR
PREAMPLIFIER
POWER AMPLIFIER
MULTIBAND RECEIVER
MULTIBAND RECEIVER
MULTIBAND RECEIVER
UHF/ VHF
PREAMPLIFIER
PREAMPLIFIER
DATA/ CONTROL BUSES
BUS TERMINAL
BUS TERMINAL
BUS CONTROLLER
BUS CONTROLLER
MULTIBAND EXCITER
FDM COUPLER
HF
PREAMPLIFIER
POWER AMPLIFER
UHF/ L-BAND
ANTENNA SELECTOR
ANTENNA SELECTOR
PREAMPLIFIER
PREAMPLIFIER
ADAPTIVE ARRAY PROCESSOR
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 8
FDM COUPLER
FDM COUPLER
POWER AMPLIFIER
MULTIBAND EXCITER
FDM COUPLER
AAC032

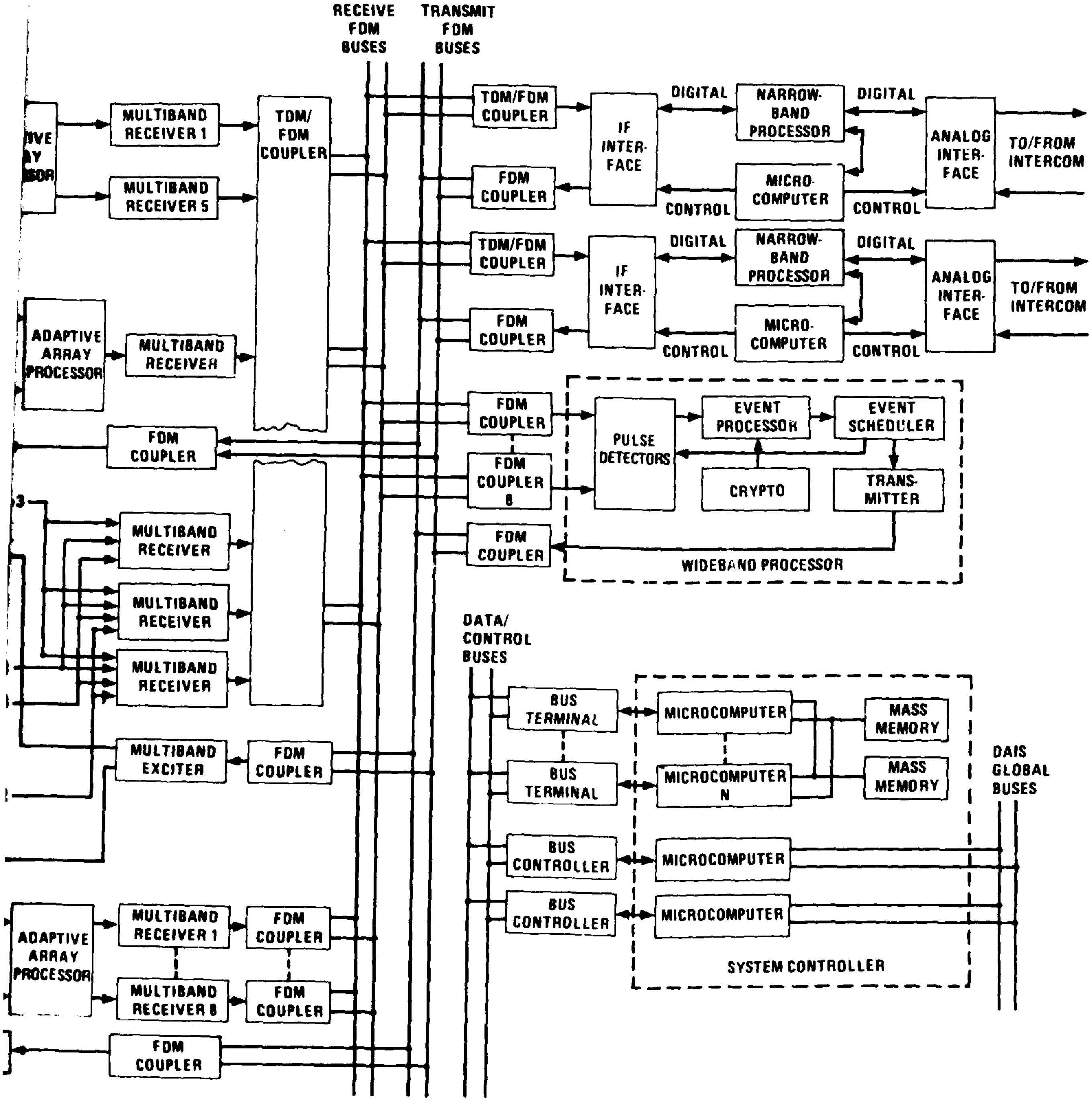


Figure 2.4.6-1. MFBARS Architecture No. 6

2.4.6.2 RF CONVERSION – Table 2.4.6.2-1 lists the major characteristics of the module set which was developed to meet the requirements of Architecture 6. The major impetus behind Architecture 6 was to make maximum use of projected antenna integration thus reducing the number of antenna apertures. In addition some modules which were separate in Architecture 3 were combined in order to achieve cost and packaging advantage. All of these appear to be within the technology capability. Table 2.4.6.2-2 is a detailed breakdown of the module set and indicates some of their more important characteristics.

2.4.6.3 WIDEBAND PROCESSOR – See Section 2.4.3.3.

2.4.6.4 NARROWBAND SIGNAL PROCESSORS – See Section 2.4.3.4.

2.4.6.5 INTERNAL SIGNAL AND DATA DISTRIBUTION – Architectures 3 and 6 feature 4 separate redundant buses as described in Table 2.4.6.5-1. Prior to coupling the signals onto the receive bus they are normalized by AGC to a level of about -10 dBm in order to minimize crosstalk between channel and to assure that the harmonics of the 70 MHz input that are created in the up conversion process will be sufficiently low level that they will not present problems. The losses associated with conversion filtering and coupling are about 54 dB; however, there is sufficient gain to prevent sensitivity degradations.

The transmit signals are coupled onto the transmit FDM bus at a higher level using very high level mixers so as to minimize the transmitted noise pedestal.

2.4.6.6 CONTROL STRUCTURE – The control structure for Architecture No. 6 is the same as for Architecture No. 3 which is described in Section 2.4.3.6.

2.4.6.7 EXTERNAL SIGNAL/DATA INTERFACES – The external signal/data interfaces for Architecture No. 6 are the same as those described for Architecture No. 3 in Section 2.4.3.7.

2.4.6.8 ELECTRICAL POWER CONVERSION CONTROL AND DISTRIBUTION – A common form of electrical power subsystem has been used for all integrated Architectures 3, 4, 5, 6 and 7. Table 2.4.6.8-1 summarizes the more important characteristics of the proposed architecture. While the basic concept was developed using Reference 1 as a starting point it has features which encourage but do not require users to employ a family of standard voltages. Furthermore it addresses the problems of bus protection, load control, load sharing and distribution line drop and EMI pickup which were not fully considered in Reference 1 since some of these problems are unique to a MFBARS approach.

2.4.6.10 PACKAGING CONCEPT – Schedule and funding limitations have prevented a complete evolution of a packaging concept; however, some preliminary conclusions and

[1] AFAL Technical Report AFAL-TR-78-59, Feb. 78.

Table 2.4.6.2-1. Architecture No. 6, RF Conversion

- Employs larger module increments than Arch. 3, 4, 5
- Uses 62 modules of 18 different types including multipurpose modules:
  - a broadband downconverter/IF capable of converting a signal anywhere in the 2 to 1600 MHz band to 70 MHz with good spurious performance
  - a multiband exciter 70 MHz input/antenna frequency output
  - a power amplifier covering all JTIDS, IFF, TACAN requirements
  - a power amplifier covering all 30-400 MHz requirements
  - a slow hop synthesizer covering all L.O. requirements for 2-400 MHz and IFF, TACAN equipments
  - a preamplifier covering all requirements from 800 to 1600 MHz
- Provides for time-sharing of the L Band transmit capability at a past rate ($< 20\mu s$)
- Provides for time-sharing of other modules at a slow rate
  - 5 receiver channels serve both GPS frequencies
  - 4 receiver channels switch between IFF/TACAN and JTIDS when JTIDS acquisition is required
  - 3 receiver channels serve all HF, VHF-FM, VHF-AM, UHF-AM and ILS functions
  - 1 exciter channel serves all HF, VHF-FM, VHF-AM, UHF-AM requirements
  - 1 power amplifier serves all VHF-FM, VHF-AM, UHF-AM requirements

Table 2.4.6.2-2. RF Conversion, Architecture No. 6

		MODULE NAME	QTY.	COST	WEIGHT	VOL.	POWER
11		VHF/UHF Preamp	3	2,866	6.0	90	10.5
12		L Band Preamp Wide	3	2,121	4.5	90	9.0
13		UHF Preamp	1	684	1.5	30	3.5
14		L Band Preamp Nar.	2	1,728	3.0	60	7.0
21		Multiband downconverter	17	13,254	42.5	763	85.0
31		Multiband Exciter	3	2,850	6.0	135	13.5
41		VHF/UHF Power Amp	2	2,814	10.0	240	50.0
42		HF Power/Preamp	1	1,716	12.0	150	110.0
43		L Band Power Amp	1	3,126	11.0	150	100.0
	2	GPS Weighting	2	10,400	16.0	420	20.0
	9	L Band Weighting	1	5,500	12.0	360	15.0
	16	UHF Weighting	1	6,300	8.0	210	10.0
61		UHF/L Band Multiplexer	2	1,061	6.0	180	0
62		UHF/L Band Diplexer	2	549	2.0	30	0
	6	GPS L.O.	1	750	1.0	30	6.0
	10	Fast Hop Synth.	2	2,350	4.0	120	20.0
	11	Slow Hop Synth.	10	7,650	20.0	600	40.0
	3	GPS PN Mod	5	3,300	6.3	150	15.0
18 different			62 Total	$69.019 Total	171.8 lbs	3,808 cu in	514.5 watts

desirable characteristics are contained in Table 2.4.6.10-1. The Hughes packaging concept[2] is a good starting point for the final package; however, it appears that some modifications may be desirable to retain full flexibility of the MFBARS approach. With MFBARS the module set within an enclosure will be user specified and therefore there is no a priori knowledge of the mix between analog, digital and RF modules, the heat dissipated by neighboring modules or the EMI problem between neighboring modules. Because of this it appears desirable to develop a single EMI shielded package which is suitable for all types of circuitry. Such a conclusion appears to result in unnecessary costs to digital and analog modules; however, since 75 to 80% of the module set is RF

[2] Draper Lab. Report, April 1978, Vol. 1 "GPS/JTIDS/IFF Integration Study".

Table 2.4.6.5-1. Internal Signal/Data Distribution, Architectures 3 and 6

Four Separated Redundant Buses
• Combination TDM/FDM Receive Bus
TDM of narrowband signals with 70 MHz carrier
FDM of wideband signals by upconverting to UHF
• FDM Transmit Bus by upconverting to UHF
• General Purpose Command/Data Bus
• High Speed Command Bus for time critical commands
Each module addressed directly from Central Processor

Table 2.4.6.8-1. Electrical Power Conversion, Control and Distribution

• All Integrated Architectures 3, 4, 5, 6, 7 Identical
• Features
Standalone converter with family of coarsely regulated voltages
Easy addition of more capacity by paralleling modules
Automatic adjustment for changes in load distribution
Fine regulation, isolation, control in each user module
Unique standalone converters for unique requirements

Table 2.4.6.10-1. Packaging Concept, Architectures 3, 4, 5, 6, 7

Preliminary Results
Specify only mechanical and electrical interface
Minimum module size approximately 5 x 6 x 1 inches
Desirable Characteristics
Low cost
Does not need adjacent modules for mechanical support
Easy installation and removal
In place access to test connectors
Adequate shielding to allow full freedom in module placement
Minimizes need for transit and storage protective devices
Accepts modules of incremental sizes
Provisions to vary cooling air to each module independently
Facilitates use of extender modules
Conclusion
Need detailed design to proceed any further

and some analog and digital modules will require shielding anyway the excess cost appears to be minor and may well be offset by a simpler mounting enclosure design.

2.4.6.11 PHYSICAL CHARACTERISTICS – Architecture 6 has projected characteristics as follows:

Volume	7973 cu in. (4.5 cu ft)
Weight	304 lbs
Number of modules	109

A detailed breakdown is shown in Table 2.4.6.11-1.

2.4.6.11(A) SOFTWARE – The software for Architecture No. 6 is the same as that described for Architecture No. 3 in Section 2.4.3.11(A).

Table 2.4.6.11-1. Breakdown of Physical Characteristics, Architecture 6

	VOLUME	WEIGHT	NUMBER OF MODULES
RF Conversion	3608	172	62
Signal Bus	405	19	17
Signal Processor	510	14	14
Bite	30	1	1
Power Supply	1800	36	6
Frequency Reference	120	2	2
Command Bus	200	7	7
Enclosures	1300	53	
Total	7973	304	109

2.4.6.12 PERFORMANCE CHARACTERISTICS – All aspects of the performance characteristics of Architecture 6 are identical to that of Architecture 3 except that Architecture 6 has a very slight increase in its rate of performance degradation as a result of failures because larger module increments are used. This increased susceptibility to failure could easily be overcome by adding redundant modules. Architecture 6 does have potential performance advantage relative to receive while transmit capability. All antennas except the HF antenna are configured as separate receive and transmit aperatures. This gives a good chance to simultaneously receive and transmit in the same band, provided suitable aircraft locations can be found to provide the necessary antenna isolation.

2.4.6.13 SENSITIVITY ANALYSIS – Architecture 6 is configured using a set of 109 modules of 34 different designs. This reduction in the number of designs was made possible by:

a. Combing the VHF, UHF amplifier into a single unit
b. Combining the GPS/L-Band preamplifier into a single unit
c. Combining the VHF, UHF preamplifiers into a single unit

While these changes provide meaningful reductions in system cost they do not solve any of the major cost/performance trade-offs as discussed in paragraph 2.4.3.13 and these trade-offs apply to Architecture 6 also.

The Architecture 6 which features separate transmit and receive antennas is particularly suited to use as a pulse radar altimeter. Typically, 0 to 5000 feet altimeters are built using 100 watt peak pulse transmitters at 4.3 GHz with a 50 ns pulse width and a receiver having a 10 dB noise figure and 20 MHz of information bandwidth. To achieve range down to 0 feet it is necessary to hold the antenna isolation to greater than 90 dB. If such a system were implemented at L band less antenna isolation would be required because of

reduced attenuation to the desired reflection. Even if the required antenna isolation were not possible to allow implementation of a 0 feet altimeter it would still be feasible to implement one down to about 50 feet by blanking the receiver through AGC action during the transmit cycle. The extra cost to implement such a system is only in the signal processing hardware while the cost of a military altimeter is in the 8 to 10K range.

2.4.6.14 RISK ASSESSMENT – The module set of Architecture 6 was created using the module set of Architecture 3 and combining certain modules. This represents a slightly increased risk, however, it is obviously possible to fall back to the Architecture 3 position as described in paragraph 2.4.3.14.

2.4.6.15 ECONOMIC ANALYSIS – Table 2.4.6.15 shows a breakdown of the LCC for Architecture 6.

In this architecture the increased cost of using integrated antenna structures are more than offset by the resultant savings in the RF conversion modules.

Furthermore, the drop in overall module count relative to Architecture 3 reflects into a corresponding reduction in the BITE, power supply and command subsystems. Overall, this architecture projects as costing 4.2% less than Architecture 3.

Table 2.4.6.15. LCC Breakdown

SUBSYSTEM	COST	% OF HARDWARE
Antennas	16.1	13 %
RF Conversion	63.8	52 %
Signal Bus	6.7	5.4%
Signal Processing	8.3	6.7%
BITE	3.8	3.2%
Power Supply	13.6	11 %
Frequency Reference	1.9	1.5%
Command Bus	6.1	4.9%
Enclosures	3.2	2.6%
Hardware Total	123.5	
Software Total	10.7	
Logistics Total	43.1	
LCC Total	177.3	K per System

2.4.7 MFBARS ARCHITECTURE NO. 7 – Architecture No. 7 is a totally non-integrated MFBARS configuration similar to Architecture No. 1. The difference between Architecture No. 7 and No. 1 is that Architecture No. 7 utilizes common modules for all of the functions where practical. Architecture No. 1 assumes that the equipment units that implement each communication function is developed separately and no common modules are used.

A block diagram of Architecture No. 7 is shown in Figure 2.4.7-1. The main features of the architecture are listed in Table 2.4.7-1.

2.4.7.1 ANTENNA CONFIGURATION – The antenna configuration assumed for Architecture No. 7 is the same as that of Architecture No. 3 as described in Section 2.4.3.1.

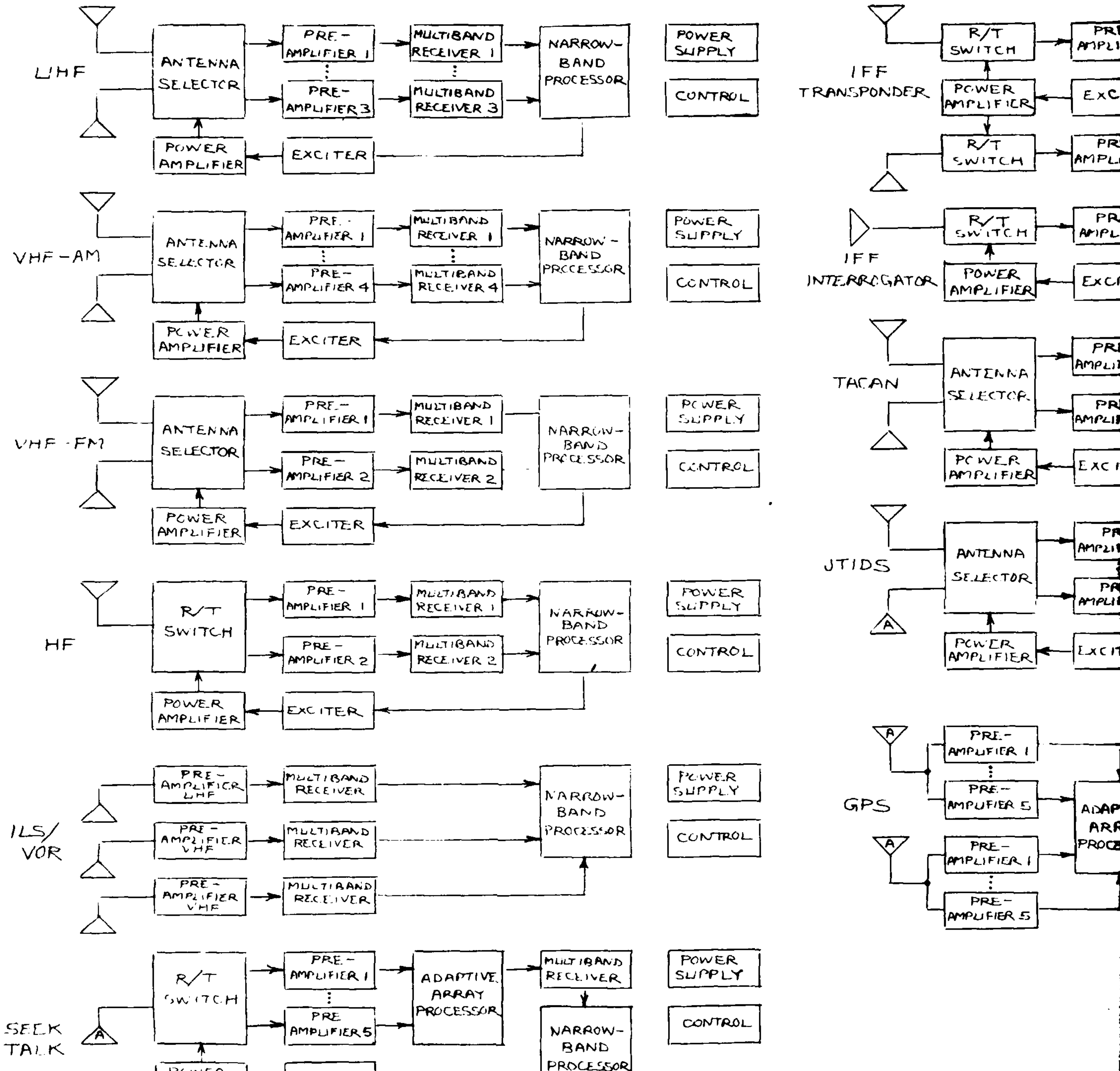
2.4.7.2 RF CONVERSION – Architecture No. 7 features a dedicated configuration employing standard modules as building blocks and exhibits major characteristics as described in Table 2.4.7.2-1. It is important to note that the module set of Architecture No. 3 which was used in generating Architecture No. 7 is not the optimum assuming that the set is not required to be compatible with both the dedicated and time-shared configuration. While an optimum set for Architecture No. 7 may show cost advantage relative to a dedicated Architecture No. 1, it appears that any attempt to use standard multipurpose modules must result in increased size and weight assuming equal funds and design capability are applied to the designs. Table 2.4.7.2-2 shows a detailed breakdown of the module set used in Architecture No. 7.

2.4.7.3 WIDEBAND PROCESSOR – See Section 2.4.3.3.

2.4.7.4 NARROWBAND SIGNAL PROCESSORS – See Section 2.4.3.4.

Table 2.4.7-1. Architecture No. 7 Features

- Equivalent to Dedicated System
- Constructed From Standard Module Set of Architecture 3
- Module Set Not Optimum for This Architecture
- Provides Good Basis for Evaluating Impact of Standard Modules by Comparing With Architecture 1
- Provides Good Basis for Evaluating Impact of Time-sharing Modules by Comparing With Architecture 3


UHF
ANTENNA SELECTOR
PRE-AMPLIFIER 1
PRE-AMPLIFIER 3
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 3
NARROW-BAND PROCESSOR
POWER SUPPLY
CONTROL
POWER AMPLIFIER
EXCITER
VHF-AM
ANTENNA SELECTOR
PRE-AMPLIFIER 1
PRE-AMPLIFIER 4
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 4
NARROW-BAND PROCESSOR
POWER SUPPLY
CONTROL
POWER AMPLIFIER
EXCITER
VHF-FM
ANTENNA SELECTOR
PRE-AMPLIFIER 1
PRE-AMPLIFIER 2
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 2
NARROW-BAND PROCESSOR
POWER SUPPLY
CONTROL
POWER AMPLIFIER
EXCITER
HF
R/T SWITCH
PRE-AMPLIFIER 1
PRE-AMPLIFIER 2
MULTIBAND RECEIVER 1
MULTIBAND RECEIVER 2
NARROW-BAND PROCESSOR
POWER SUPPLY
CONTROL
POWER AMPLIFIER
EXCITER
ILS/VOR
PRE-AMPLIFIER UHF
PRE-AMPLIFIER VHF
PRE-AMPLIFIER VHF
MULTIBAND RECEIVER
MULTIBAND RECEIVER
MULTIBAND RECEIVER
NARROW-BAND PROCESSOR
POWER SUPPLY
CONTROL
SEEK TALK
A
R/T SWITCH
PRE-AMPLIFIER 1
PRE AMPLIFIER 5
ADAPTIVE ARRAY PROCESSOR
MULTIBAND RECEIVER
NARROW-BAND PROCESSOR
POWER SUPPLY
CONTROL
POWER AMPLIFIER
EXCITER
IFF TRANSPONDER
R/T SWITCH
POWER AMPLIFIER
R/T SWITCH
IFF INTERROGATOR
R/T SWITCH
POWER AMPLIFIER
TACAN
ANTENNA SELECTOR
POWER AMPLIFIER
JTIDS
A
ANTENNA SELECTOR
POWER AMPLIFIER
GPS
A
PRE-AMPLIFIER 1
PRE-AMPLIFIER 5
A
PRE-AMPLIFIER 1
PRE-AMPLIFIER 5

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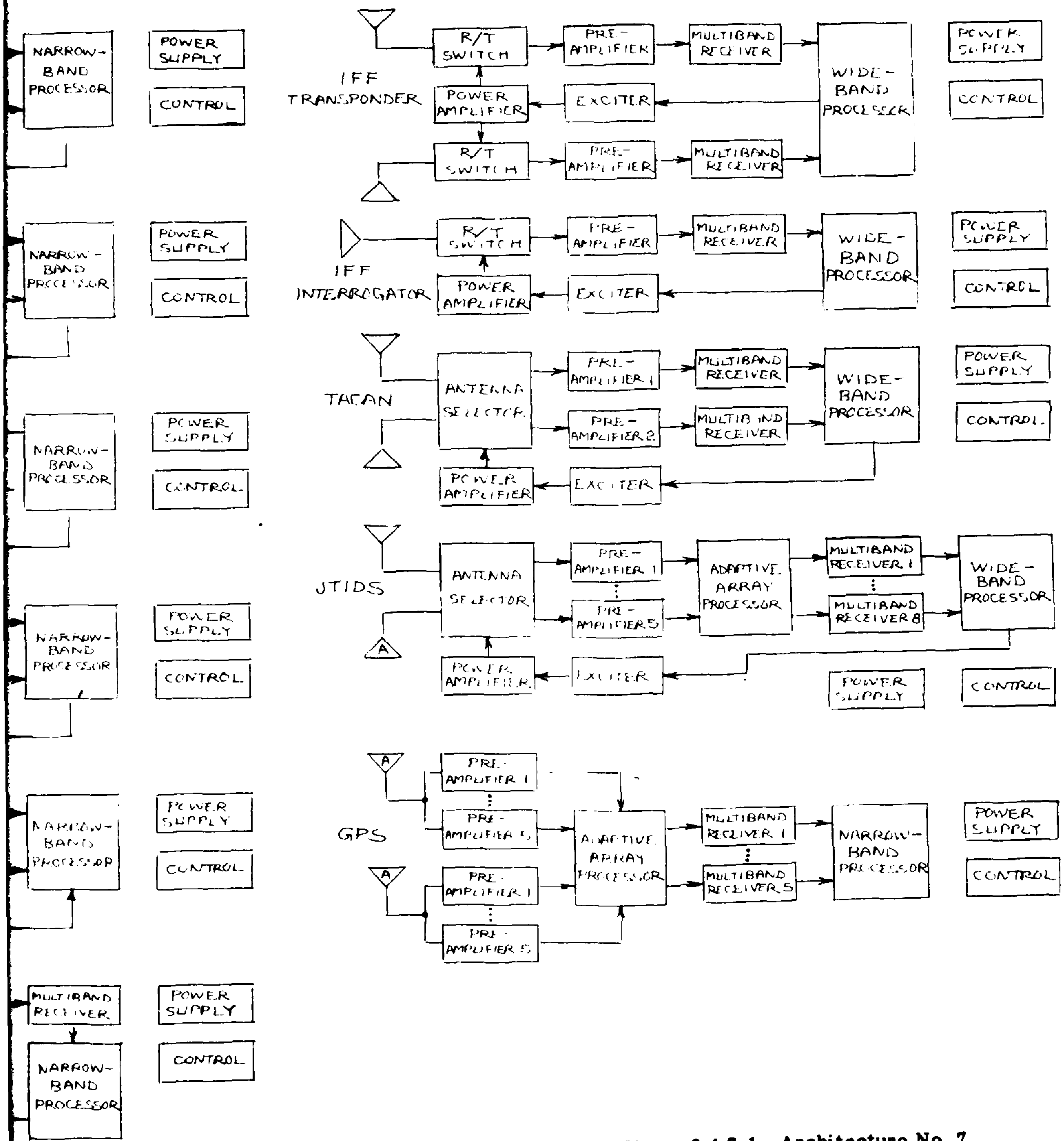

Figure 2.4.7-1. Architecture No. 7
Block Diagram

2

Table 2.4.7.2-1. Architecture No. 7, RF Conversion

• Employs module set from Architecture No. 3
• Uses 156 modules of 23 types
• A more cost-effective set of modules could be developed for Architecture No. 7, however, care must be taken to insure that a time-shared configuration would not be excessively penalized.
• Employs no time-sharing of modules between systems

2.4.7.5 INTERNAL SIGNAL/DATA DISTRIBUTION – This architecture does not utilize buses for internal signal/data distribution. Each function is independent and dedicated cables and wiring are used as in Architecture Nos. 1 and 2.

2.4.7.6 CONTROL STRUCTURE – We assumed dedicated displays and controls similar to those in current use. The cost of these dedicated displays and controls is not considered because the displays and controls for the integrated MFBARS architectures (Nos. 3 through 6) are implemented by DAIS and that cost is not included in our study.

2.4.7.7 EXTERNAL SIGNAL/DATA INTERFACES – Architecture No. 7 assumes hardwire dedicated interfaces with the intercom, display/control units and with a computer for the data interface.

2.4.7.8 ELECTRICAL POWER CONVERSION CONTROL AND DISTRIBUTION – A common form of electrical power subsystem has been used for all integrated Architecture Nos. 3, 4, 5, 6 and 7. Table 2.4.7.8-1 summarizes the more important characteristics of the proposed architecture. While the basic concept was developed using reference 1 as a starting point, it has features which encourage but does not require users to employ a family of standard voltages. Furthermore, it addresses the problems of bus protection, load control, load sharing, and distribution line drop and EMI pickup which were not fully considered in reference 1 since some of these problems are unique to a MFBARS approach.

2.4.7.10 PACKAGING CONCEPT – Schedule and funding limitations have prevented a complete evolution of a packaging concept, however, some preliminary conclusions and desirable characteristics are contained in Table 2.4.7.10-1. The Hughes packaging concept[1] is a good starting point for the final package, however, it appears that some modifications may be desirable to retain full flexibility of the MFBARS approach. With MFBARS, the module set within an enclosure will be user specified and, therefore, there is no a priori knowledge of the mux between analog, digital, and RF modules, the heat dissipated by neighboring modules or the EMI problem between neighboring modules.

Reference 1: AFAL Technical Report AFAL-TR-78-59, Feb. 78.

[1]Draper Lab. Report, Apr. 78, Vol. 1, "GPS/JTIDS/IFF Integration Study"

Table 2.4.7.2-2. RF Conversion, Architecture No. 7

NO.	NAME	QTY	COST	WT.	VOL.	POWER
1	GPS Preamp	5	1,960	5.0	150	5
2	GPS Weighting	2	10,400	16.0	420	20
3	GPS PN Mod	5	3,300	6.3	150	15
4	Var. IF	33	15,800	50	990	99
5	70 MHz IF	33	14,950	50	990	132
6	GPS L.O.	1	750	1.0	30	6
7	L-Band Preamp Wide	4	1,350	4.0	120	16
8	L-Band Preamp Narrow	7	2,750	7.0	210	28
9	L-Band Weighting	1	5,500	12.0	360	15
10	FH Synthesizer	2	2,350	4.0	120	20
11	SH Synthesizer	26	16,400	52.0	1,560	104
12	Ant. Select	9	2,350	9.0	270	18
14	L-Band TX	4	8,100	36.0	960	360
15	UHF Preamp	5	2,700	6.2	150	15
16	UVHF Weighting	1	6,300	8.0	210	10
17	UVHF TX	2	2,650	4.0	300	24
18	Multiband Exciter	9	5,350	13.5	270	54
19	VHF-AM TX	1	1,800	4.0	150	10
20	VHF-FM TX	1	1,700	3.0	120	8
21	HF TX	1	1,900	6.0	180	80
22	VHF AM Preamp	2	1,600	2.5	60	6
23	VHF FM Preamp	1	950	1.2	30	3
24	HF Preamp	1	1,000	1.3	30	4
23 Diff.		156 Total	$111,340	302.0	7,730	1,044

Table 2.4.7.8-1. Electrical Power Conversion, Control, and Distribution

- All integrated Architecture Nos. 3, 4, 5, 6, 7 identical
- Features:

  Stand-alone converter with family of coarsely regulated voltages

  Easy addition of more capacity by paralleling modules

  Automatic adjustment for changes in load distribution

  Fire regulation, isolation, control in each user module

  Unique stand-alone converters for unique requirements

Table 2.4.7.10-1. Packaging Concept, Architecture Nos. 3, 4, 5, 6, and 7

Preliminary Results:

  Specify only mechanical and electrical interface

  Minimum module size approximately 5 x 6 x 1 inches

Desirable Characteristics

  Low cost

  Does not need adjacent modules for mechanical support

  Easy installation and removal

  In place access to test connectors

  Adequate shielding to allow full freedom in module placement

  Minimizes need for transit and storage protective devices

  Accepts modules of incremental sizes

  Provisions to vary cooling air to each module independently

  Facilitates user of extender modules

Conclusion:

  Need detailed design to proceed any further

Because of this, it appears desirable to develop a single EMI shielded package which is suitable for all types of circuitry. Such a conclusion appears to result in unnecessary costs to digital and analog modules, however, since 75 to 80% of the module set is RF and some analog and digital modules will require shielding any way, the excess cost appears to be minor and may well be offset by a simpler mounting enclosure design.

2.4.7.11 PHYSICAL CHARACTERISTICS – Architecture No. 7 has projected characteristics as follows:

Volume	15,870 cu in (9.1 cu ft)
Weight	509 lbs
Number of modules	231

A detailed breakdown is shown in Table 2.4.7.11-1.

2.4.7.11(A) SOFTWARE – Architecture No. 7 was assumed to require the same software development for JTIDS, GPS and SEEK TALK as the integrated architectures. This software is described in Table 2.4.7.11(A)-1.

2.4.7.12 PERFORMANCE CHARACTERISTICS – Architecture 7 has performance characteristics and signal handling characteristics identical to those of Architecture 1 since it is only a dedicated architecture implemented with standard modules.

Table 2.4.7.11-1. Breakdown of Physical Characteristics, Architecture 7

	VOLUME	WEIGHT	NUMBER OF MODULES
RF Conversion	7,730	302	156
Signal Bus	0	0	0
Signal Processor	1,890	53	53
BITE	0	0	0
Power Supply	3,630	66	11
Frequency Reference	420	11	11
Command Bus	0	0	0
Enclosures	2,200	77	
Total	15,870	509	231

Table 2.4.7.11(A)-1. MFBARS Architecture No. 1 (Software)

FUNCTION	TOTAL MEMORY AVAILABLE	TOTAL MEMORY REQUIRED	MEMORY FOR INSTRUCTIONS
GPS Signal Processing	48K	30K (16 bit)	20K
SEEK TALK	24K	15K (16 bit)	10K
Adaptive Antenna	12K	8K (8 bit)	4K
GPS Position Computations			21K
JTIDS Relative Navigation			21.6K
Executives			10K

2.4.7.13 SENSITIVITY ANALYSIS – Architecture 7 was configured using 231 modules of 34 different designs. The module set used was that of Architecture 3; however, since this is a dedicated architecture the modules associated with the signal bus, BITE, and command bus were not required with a corresponding reduction in the number of different designs. All of the performance/cost tradeoffs which are applicable to Architecture 3 are applicable here.

2.4.7.14 RUSH ASSESSMENT – The module set of Architecture 7 is identical to that of Architecture 3 minus the central command and control. Thus the risk will be slightly less than that of Architecture 3.

2.4.7.15 ECONOMIC ANALYSIS – Table 2.4.7.15 shows a breakdown of the LCC for Architecture 7.

Overall this architecture is significantly more expensive than Architecture 3. Major increases are evident in the RF conversion, signal processing and power supply subsystems where the possibility of time and parallel sharing are not used. Overall this architecture projects as costing 31% more than Architecture 3. Despite the failure to

Table 2.4.7.15. LCC Breakdown

SUBSYSTEM	COST	% OF HARDWARE
Antenna	13.8	7.2%
RF Conversion	95.7	50%
Signal Bus	0	0
Signal Processing	24.9	12.8%
BITE	8.0	4.1%
Power Supply	25.5	13.2%
Frequency Reference	7.9	4.0%
Command Bus	7.5	3.8%
Enclosures	4.1	2.1%
Hardware Total	191.5	
Software Total	6.3	
Logistics Total	46.0	
LCC Total	243.8	K per System

exploit the power of time-sharing this architecture projects as costing 15% less than the unique dedicated Architecture 1 with almost all of these saving as a result of reduced spares and logistics costs.

3. CRITERIA FOR SELECTING MFBARS ARCHITECTURE

In selecting the criteria for evaluating the various MFBARS architectures it is necessary to expand the normal list of criteria to include those characteristics which are unique to the MFBARS architecture concept. In particular the flexible standard module approach must be rated on its ability to put new concepts on the flight line in an expeditious and cost-effective manner, to upgrade specific standard modules of an existing system without affecting other modules, to provide the airframe manufacturer with small modules which are easily integrated into the airframe and to provide the pilot with better mission effectiveness through graceful degradation and a unified approach to BITE. These considerations have been added to the normal list of rating elements, i.e., cost, size, weight, etc. to arrive at our final rating criteria.

3.1 SELECTED CRITERIA

The following list and description of rating criteria were selected as being a compromise between a fully exhaustive but cumbersome rating set and a simple, easy to use set which does not provide necessary insight into the differences between architectures

Rating Element	Discussion
LCC	This rating covers all acquisition and maintenance costs for the MFBARS system.
Size	This rating element impacts not only the initial cost of designing the airframe but the operational costs of flying since it displaces possible stores.
Weight	This element impacts initial installation costs and flight costs since the fuel area required to carry the weight displaces possible stores.
Upgrade Ability	This unique characteristics of the MFBARS approach is of great significance not only in its ability to reduce acquisition cost of new or upgraded capability but in the ability to quickly counter new mission requirements. This criterion also considers the ability of the architecture to incorporate new, improving technologies.
Power Consumption	Relative to the total power drawn by the airframe avionics the MFBARS system is only a small fraction. This rating element appears to be of great importance only if it impacts the normal airframe cooling system because of extreme high density heat loads.

Detailed System Performance	All MFBARS concepts considered should have detailed performance characteristics which are quite comparable to the dedicated equipment. Architectures with gross degradation were not considered. Thus this rating will have little effect on mission effectiveness.
Installation Flexibility	The MFBARS concept uses standard small modules which are grouped in enclosures to form working systems. There is no requirement that all of the modules of a given system be together. In general small modules will allow more installation flexibility.
Graceful Degradation	Since many modules which comprise the MFBARS system are time-shared. It is important to consider the impact of single point failures on avionics capability. In general, failure of a MFBARS module causes loss of simultaneous signal handling speed not loss of a specific capability.
Risk	This rating factor is not nearly as important in the MFBARS approach as it is in a dedicated approach. The ability to easily upgrade specific areas without affecting other modules provides a cost and schedule effective means of overcoming areas where risk did not pay off.
Antenna Installation	The cost and performance degradation of both the avionics and airframe as a result of antenna installation can be quite severe for high performance aircraft. The ability to minimize drag while enhancing avionics performance is an important rating criteria.

3.2 WEIGHTING OF CRITERIA

The relative weighting of each of the rating elements is one area where significant controversy is likely to exist. Many of these differences are based on real world considerations which are not only illogical but which vary with the political and international situation. Based on past avionics integration and maintenance experience at our Fort Worth and Electronics Divisions we arrived at the following recommended weighting factors:

LCC	25%
Weight	15%
Size	15%
Upgrade Ability	15%
Power	5%
Detailed Performance	5%
Installation Flexibility	5%
Graceful Degradation	5%
Risk	5%
Antenna Installation	5%
	100%

3.3 COMPARISON OF MFBARS ARCHITECTURES

After selecting and weighing the various MFBARS weighting elements the only remaining task is to rate the various architectures relative to each element. Since obviously bad architectures have been screened out prior to final consideration, it is expected that the differences between architectures would fall into the "slightly better" category for many of the weighting elements. Because of this the differences were rated on a "log" type scale in order to distinguish between architectures. In assigning the rating the best architecture has been assigned a 1.0 rating and all others ranked relative to 1.0.

3.4 SELECTION OF THE MOST PROMISING ARCHITECTURE

Table 3.3-1 shows the results of the comparison of the various MFBARS architectures. Although 5 different architectures are compared, Architectures 4 and 5 are only minor variations of Architecture 3 and similar variations could be applied to Architecture 6 with corresponding effect on the final rating. Thus it appears desirable to compare the results of Architectures 3, 6, and 7 directly and then consider the impact of variations 4 and 5.

As seen from Table 3.3-1 the final ratings of the three major architectural variations are:

Architecture	Rating
6	98.10
3	94.05
7	75.25

Table 3.3-1. Comparison of MFBARS Architectures

RATING ELEMENT	WEIGHING	Architecture 3 RATING	3 SCORE	4 RATING	4 SCORE	5 RATING	5 SCORE	6 RATING	6 SCORE	7 RATING	7 SCORE
LCC	25	.9	22.5	.85	21.25	.95	23.75	1.0	25.0	.6	15.0
Weight	15	.95	14.25	.95	14.25	.98	14.70	1.0	15.0	.6	9.0
Size	15	.95	14.25	.95	14.25	1.0	15.0	.95	14.25	.6	9.0
Upgrade Ability	15	1.0	15.0	1.0	15.0	1.0	15.0	1.0	15.0	1.0	15.0
Power	5	.98	4.9	.9	4.5	1.0	5.0	.99	4.95	.5	2.5
Detailed Performance	5	.95	4.75	.6	3.0	1.0	5.0	.95	4.75	1.0	5.0
Installation Flexibility	5	.95	4.75	1.0	5.0	.90	4.5	.95	4.75	1.0	5.0
Graceful Degradation	5	1.0	5.0	1.0	5.0	1.0	5.0	.98	4.9	1.0	5.0
Risk	5	.98	4.9	.98	4.9	1.0	5.0	.95	4.75	1.0	5.0
Antenna Installation	5	.95	4.75	.95	4.75	.95	4.5	.95	4.75	.95	4.75
Total Rating	100		94.05		90.9		97.7		98.1		75.25

The Architecture 4 modification which could be applied to either Architecture 3 or 6 would result is a poorer overall rating by about 3.15%. Similarly the Architecture 5 modification would result in a better overall rating of about 3.65%. It is important to note that with the MFBARS modular concept the basic Architectures 3 and 6 and then modifications 4 and 5 are not mutually exclusive.

This analysis indicates that the Architecture 6 is the best form which has been identified so far. This architecture features the combining of some individual modules of Architecture 3 into larger modules and separate transmit and receive antennas with multiband frequency coverage in some antennas.

Time and funding limitations have prevented further extension of this concept into the more risky areas, however certain opportunities exist to further combine modules. These opportunities include:

a. A single multielement array weighting module

b. A single synthesizer which provides GPS stability, fast hop switching speed and slow hop switching increments

c. Larger module increments in the signal processors

The feasibility and effectiveness of these combined modules should be explored in the next phase.

4. ECONOMIC EVALUATION

4.1 INTRODUCTION AND SUMMARY

Economic analysis of MFBARS architectures was initiated using the models cited in Figure 4.1-1. PRICE is an acronym for Programmed Review of Information for Costing and Evaluation. There are three models: PRICE 83B for hardware development and production costs; PRICE L1 for support cost; and PRICE 5 for software cost.

LSC-RLA is an acronym for Logistics Support Cost-Repair Level Analysis, which is an Air Force model. The GDE in-house model is an existing general purpose Cost-Availability-Spares (CAS) model.

Current status of the economic analysis is shown in Figure 4.1-2. PRICE models have been used for estimating software cost and hardware development, production, and support costs. Hardware development and production cost estimates have been made for each unique unit (or same unit with different quantities) that appears in one or more architectures. PRICE L1 was used for support cost because it requires less effort to use than the LSC-RLA model if PRICE 83B has previously been used for development and production costs. Support costs have been estimated for architectures one (dedicated) and three (integrated). Support costs for the other architectures will be done in the next

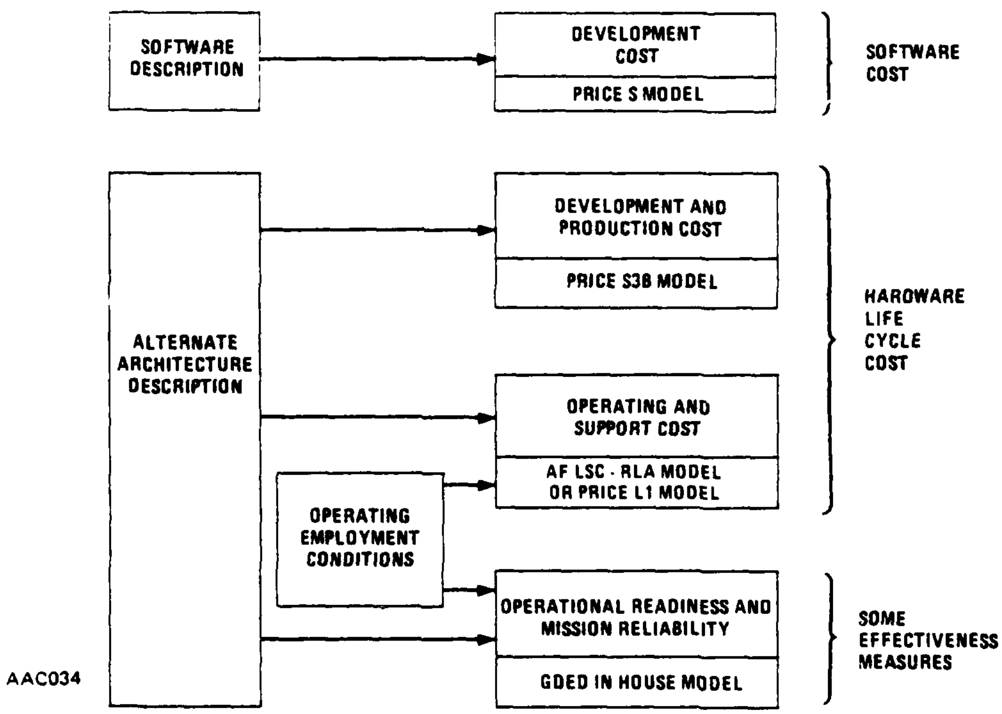

Figure 4.1-1. Economic Analysis Approach for Each Architecture

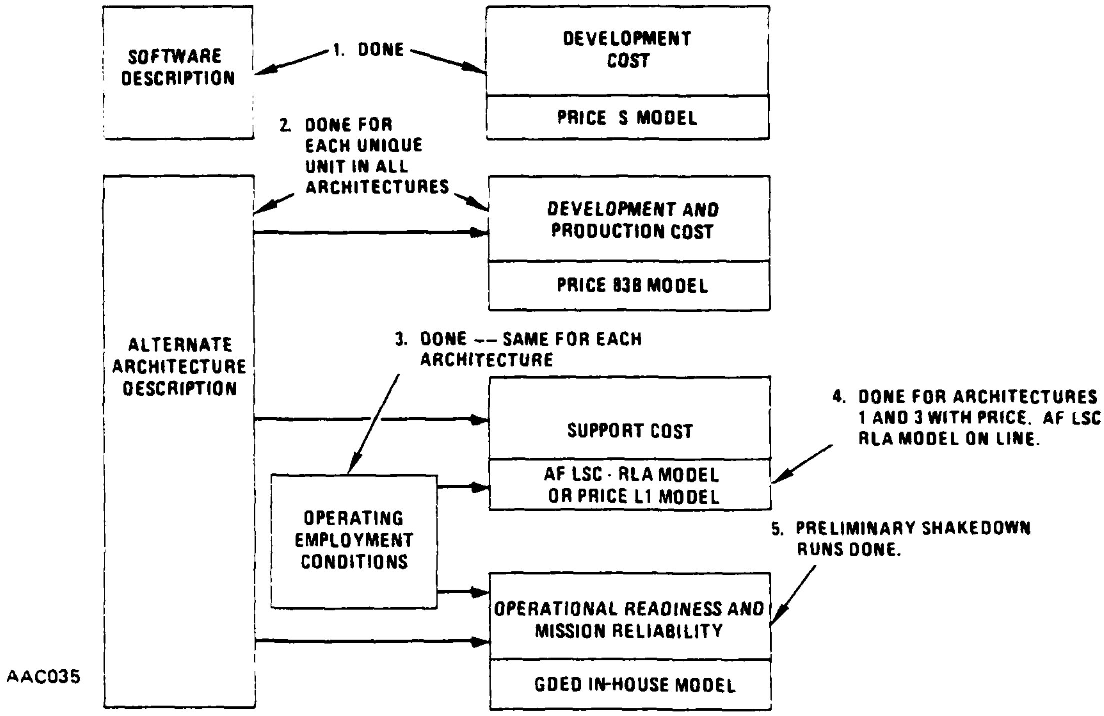

Figure 4.1-2. Economic Analysis Status

phase. Outputs from the PRICE models have been manually categorized and extrapolated in Section 3 so that costs are obtained for all architectures and for features (e.g., power supply, BITE, etc.) within each architecture.

GDE has the LSC-RLA model on-line on the IBM 370. An earlier version of MFBARS architecture one was run on both the PRICE L1 and the LSC-RLA model. The two support cost estimates were comparable. The GDE in-house CAS model will be used subsequently in Phase II for obtaining operational readiness and mission reliability estimates. No additional input data are required for CAS. Some shakedown runs have been made on a dedicated architecture.

RESULTS – Cost summaries for Architectures One (Dedicated) and Three (Integrated) are presented in Table 4.1-1. All Architecture Three cost elements except software are lower than Architecture One. The total integrated costs are 36 percent ($96,353,000) less than the dedicated. Some evaluation criteria in non-dollar units are presented in Table 4.1-2. These indicators are from inputs and outputs associated with the economic evaluation.

PRICE CONCLUSIONS – The economic evaluation activity centers about the PRICE models. Conclusions concerning PRICE are collected by its advantages and disadvantages, with the advantages outweighting the disadvantages. Much of the disadvantage is nonrecurring, i.e., structuring MFBARS features and learning PRICE drivers. Note that PRICE models are very general, as there are numerous built-in (or default) variable

Table 4.1-1. Total Costs for Architectures One and Three

	ARCHITECTURE 1 DEDICATED		ARCHITECTURE 3 INTEGRATED	
	$1000	%	$1000	%
Acquisition				
Development (10 systems)	64,006		16,278	
Production (1000 systems)	117,421		102,128	
Subtotal	181,427	68	118,406	69
Support*				
Support Equip	52,749		18,602	
Manpower	7,012		5,054	
Supply	24,667		21,087	
Supply Adm.	1,235		409	
Other	1,322		132	
Subtotal	86,985	32	45,284	26
Hardware Total	268,412		163,690	
Software	neg.		8,369	5
TOTAL	268,412		172,059	

Excludes Antennas
*Least costly of repair or throwaway for each unit in an architecture.

Table 4.1-2. Some Economic Indicators for Architectures One and Three

	ARCHITECTURE 1 DEDICATED	ARCHITECTURE 3 INTEGRATED
No. item types*	15	41
Total no. items	15	138
Total No. enclosures	15	10
Total weight (lbs)	325	325
Total electronic weight (lbs)	133.5	120
Avg. item electronic weight (lbs)	8.9	.87
MTBF (hrs)	49	52.9

as well as the required input variables. The built-in (or default) variables are to be adjusted for the situation being modeled.

Advantages of PRICE:

- Provides orientation for structuring the analysis
- Ease of data file management and change
- Widely available methodology promotes ready transfer of results as well as work in process
- Extensive calculations are rapidly and accurately done

Disadvantages of PRICE:

- Time and effort are required to structure MFBARS architectures
- PRICE is designed about the typical LRU, whereas MFBARS integrated architectures contain many module sized packages which are essentially LRUs
- Large data files are required to identify individually the modules noted above, as well as special handling for support cost and manual MTBF adjustments
- Engineers are not accustomed to estimating some PRICE input variables, e.g., weight of electronics and engineering complexity factor

PHASE II CONTINUATION – The Phase II economic evaluation will be an orderly continuation of the Phase I activity.

Continue to use the PRICE models for economic evaluation.

Continue to review the input data for consistency and error.

Continue to review the output cost estimates for reasonableness.

Refine as necessary the manner in which the PRICE models are structured for MFBARS. Only minor adjustments are anticipated.

Complete the support cost estimates for all architectures of interest.

Perform an operational readiness/mission reliability evaluation for all architectures of interest.

Give more emphasis to tabulations of evaluation and cost indicators, i.e., evaluation criteria in non-dollar units.

4.2 DEVELOPMENT AND PRODUCTION COSTS

PRICE 83B provides estimates of hardware acquisition costs (development and production) during the conceptual phase of a program.

This section includes the manner in which PRICE 83B was used for MFBARS evaluations and a summary of hardware acquisition costs for Architectures One (Dedicated) and Three (Integrated). Appendix E contains the hardware development and production costs (only) for each unique unit (or same unit with different quantities) that appears in one or more architectures. Appendix 4.B contains the full page output (i.e., Figure 4.2.1-1 format) for these same units.

4.2.1 PRICE 83B INPUTS AND OUTPUTS

PRICE 83B inputs are principally physical characteristics of the design concept. These include size, weight, type of componentry, power dissipation, and construction type, as well as the prototype and production quantities. PRICE 83B inputs require no more detailed level information than would be required for any valid estimate of system engineering and production costs.

PRICE 83B outputs feature recurring and nonrecurring costs for development and production phases. Output costs are categorized by such elements as Drafting, Design, Project Management, Prototype, and Special Tools and Test Equipment. PRICE 83B also provides an engineering schedule and a measure of its credibility. Variations of parameters such as physical features, componentry, percentage of new design, and reliability specification (MTBF) can be quickly assessed. Figure 4.2.1-1 is the PRICE output for the GPS unit of MFBARS Architecture 1. Cost elements are defined in Table 4.2.1-1. The top third of the form contains the inputs to the study. The rest of the form presents the cost estimates, schedules and estimated cost ranges.

4.2.2 USING PRICE 83B FOR MFBARS

A meaningful level of effort was required in order to set up PRICE 83B for MFBARS evaluations. Some experience with PRICE 83B was required for design engineers to estimate the input drivers. Highlights of this activity are described.

4.2.2.1 DETAIL LEVEL DETERMINATION – A basic consideration for using PRICE models for MFBARS is the detail packaging level that needs to be used in order to reflect economic differences between dedicated and integrated architectures. It is necessary to avoid becoming bogged down in detail, but still the simulation must model sufficient detail to identify economic differences. PRICE models apparently were initially designed for an input level of the traditional electronic black box, i.e., an avionics LRU

INPUT

```
MA100 GPS

INPUT DATA                                PRICE  83B 18-OCT-78   10:56
QTY      1000. PROTOS   10.0 WT      60.000 VOL      0.680 MODE      1.
QTYSYS      1. INTEGE  0.010 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      25.000 MCPLXS   5.520 PRODS    0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   7.974 PRODE    0.000 NEWEL    1.000 DESRPE   0.000
PWR    150.000 CMPNTS    420. CMPID    0.000 PWRFRC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    34.0 ENMTHP    24.0 ENMTHT    32.0 ECMPLX   2.500 PRNF     0.000

PRODUCTION
PRMTHS   116.0 PRMTHF     0.0 LCURVE   0.878 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA     1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PRPROJ   1.000 PDATA    1.000 PTLGTS    1.00
```

COST ESTIMATES

```
PROGRAM COST             DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                     1726.              53.            1779.
 DESIGN                       7700.             149.            7849.
 SYSTEMS                      2697.               0.            2697.
 PROJ MGMT                    2641.            1123.            3764.
 DATA                         1196.              53.            1250.
  SUBTOTAL(ENG)              15960.            1379.           17339.

MANUFACTURING
 PRODUCTION                      0.           21211.           21211.
 PROTOTYPE                    1561.               0.            1561.
 TOOL-TEST EQ                  208.             726.             934.
  SUBTOTAL(MFG)               1769.           21937.           23706.

  TOTAL COST                 17729.           23316.           41045.
```

CHECK VALUES

```
AUCOST              21.21              TOTAL AU PROD COST           23.32
WT      60.000 VOL         0.680 ECNS     0.030 NEWST    1.000 DESRPS 0.202
LCURVE   0.878                   ECNE     0.111 NEWEL    1.000 DESRPE 0.000

MECH STRUCT
WS      25.000 WSCF       36.743 MECID    0.000 PRODS  3.865 MCPLXS   5.520
ELECTRONICS
WE      35.000 WECF       60.518 CMPID    0.000 PRODE  4.136 MCPLXE   7.974
PWR    150.000 CMPNTS      420.                 PWRFRC 0.249 CMPEFF-17.490
```

SCHEDULE

```
SCHEDULES
ENMTHS  34.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF      0.167
PRMTHS 116.000 PRMTHF 147.834 AVER. PROD RATE PER MONTH          31.412
```

COST RANGES

```
COST RANGES               DEVELOPMENT       PRODUCTION       TOTAL COST
       FROM                  15035.           18117.           33152.
       CENTER                17729.           23316.           41045.
       TO                    21870.           31919.           53789.
```

AAC036

Figure 4.2.1-1. PRICES 83B Output Example – Architecture One, GPS Unit

Table 4.2.1-1. PRICE 83B Cost Elements

COST ELEMENT	DEVELOPMENT	PRODUCTION
1. Drafting	1. Manufacturing drawings 2. Data lists 3. Specifications 4. All other documentation required for manufacture	1. Incorporation of Engineering Changes (ECN) to drawings
2. Design	1. Development engineering 2. Design engineering 3. Normal laboratory experimental work 4. Normal breadboarding and testing	1. Engineering/Manufacturing liaison (factory follow, requisition engineering)
3. Systems	1. Effort to convert user performance requirements into workable in-house design specifications	N/A
4. Project Management	1. Program Management and Control 2. Travel and living expenses 3. Reliability 4. Maintainability 5. Quality Assurance 6. Computer operation cost 7. Preparation of in-house reports	1. Manufacturing Factory follow costs (Processing, Methods Engineering) 2. All items in the Development column but production related

Table 4.2.1-1. PRICE 83B Cost Elements (Continued)

COST ELEMENT	DEVELOPMENT	PRODUCTION
5. Data	1. Operation and Maintenance Manuals 2. Spares lists 3. Deliverable drawings 4. Status Reports 5. All items associated with normal DD-1423 CDRL requirements (except software)	1. All items associated with normal DD-1423 CDRL production requirements (except software)
6. Production	N/A	1. Material, including handling costs and floor shrinkage 2. Direct assembly and test labor costs ("touch" labor) 3. Overhead (composite) 4. Set-up costs
7. Prototype	1. Prototype material, including handling and floor shrinkage 2. Assembly and test labor costs 3. Overhead (composite) 4. Qualification costs	N/A
8. Tool-Test Equipment	1. Special tools 2. Special test equipment (non-capital) (includes design of special tools and test equipment)	1. All items in the development column, but production related

or a drawer from an electronic rack. Thus, for dedicated architectures, most of the functions, i.e., UHF, TACAN, etc., are each a single packaging level. (Very large items weighing more than 60 pounds, i.e., JTIDS, were subdivided into several units.) In order to better understand how to properly model the integrated architectures, PRICE 83B sensitivity studies were made.

Effects of differences in the following PRICE 83B inputs were studied:

- Amount of electronic repetition (DESRPE)
- Complexity factor for electronics (MCPLXE)
- Quantity and quantity per system (QTY, QTYSYS)
- Learning curve rate (LCURVE)

Abbreviations in parenthesis are the PRICE 83B variable identification.

Also, an electronic unit was described for PRICE 83B in two ways. One description was a single input (i.e., one PRICE 83B box), and the other was five inputs (i.e., five PRICE 83B boxes: an analog circuit card type, two digital circuit card types, an enclosure, and an integration and test). The end product of each is identical, an electronic black box consisting of two each of the three circuit card types.

The following effects of variations of the inputs on costs were indicated:

	Development Cost	Unit Production Cost
DESRPE (Δ.4)	Strong	Little
MCPLXE (Δ.005)	Little	Moderate
QTY (Δ500)	None	Strong
LCURVE (Δ.007)	None	Moderate

There was little interaction between these variables. Development cost for the single input description was lower than for the five input description.

The conclusion was that larger packaging levels which contain significant amounts of multiple use modules must be broken down to the module level. PRICE 83B design repeats DESRPE will not pick up unit production cost savings of multiple usage items. Total quantity QTY and learning curve LCURVE must be applied individually to the multiple usage items. Also, it is desirable to identify modules individually for integrated architectures (and units for dedicated architectures), as the same module will often appear in several architectures. Somewhat higher development cost for using more input description (i.e., the five input description versus the one input description) is reasonable for this study. Interface specifications will be more stringent for multiple usage modules.

4.2.2.2 EXPERIENCE ROLE – Experience with PRICE 83B during this MFBARS study indicated that the input variables weight of structure WS and weight of electronics (WT-WS) were sensitive for all costs and that the engineering complexity ranking factor, ECMPLX, was sensitive for development cost. Design engineers are not accustomed to working with these variables.

Also, experience indicated that the input variables volume VOL, power dissipation PWR, and number of detail electrical parts CMPNTS, have little or no effect on costs. Yet design engineers are accustomed to working with these variables.

Some usage with PRICE 83B by design engineers is necessary for them to make consistent estimates of weights and engineering complexity ranking factors. Once this learning experience occurs, PRICE 83B can be satisfactorily used for MFBARS studies. Still it is unfortunate that volume, power dissipation, and number of parts are not stronger drivers for PRICE 83B cost estimates.

4.2.2.3 ECIRP EVALUATION – ECIRP is a PRICE 83B mode that generates empirical data sets (i.e., electronic and structural complexity factors) from cost experience data (i.e., unit cost, quantity, weight of structure, weight of electronics, etc.). An evaluation was made of the pertinence of ECIRP to the MFBARS study.

Input data for ECIRP were obtained for several existing units of a dedicated architecture: TACAN ARN-118, UHF ARC-164, VHF ARC-115, IFF APX-101, ILS ARN-108. Electronic complexity factors were obtained using ECIRP. The units all exist and, therefore, are pre-1978 technology. A MFBARS ground rule is that all architectures are to be for 1985 technology. There will be increased digital functions and increased large scale integration in 1985 technology avionics units. Therefore, it is best to estimate the electronic complexity factor for dedicated units in the same manner used for integrated units. Electronic complexity factors for all units were estimated using the PRICE reference manual table for circuit functions and technology. Also, as most units contained multiple circuit functions, it was necessary to use the PRICE PARASYN mode. The PRICE ECIRP mode was not used further in the study.

4.2.3 INPUT DATA GROUND RULES

Inputs for PRICE 83B for development and production costs were obtained as described below. Abbreviations in parenthesis are the PRICE 83B variable identification. Presence of (AF) along with the abbreviation indicates that the value used was suggested by the Air Force MFBARS program office.

The following inputs apply to each unit in all architectures:

1000 production units (QTY, QTYSYS) (AF)

10 prototypes (PROTOS, QTYSYS) (AF)

Level of electronic integration and test is not applicable for non-integrated Architectures One and Two. The level for integrated architectures is high in order to include the integration of modules into enclosures and then a complete integration of all units within the entire architecture. Similar for mechanical integration (INTEGE, INTEGS)

50% G&A, IR&D, and fee mark-up (AMULTE, AMULTM) (AF)

January 1985 engineering development start for most complex unit (ENMTHS) (AF)

Development period to completion of first prototype in accordance with PRICE equation (ENMTHP)

Completion of development requires six additional months for most units or eight for complex units (ENMTHT)

Production start based on completion of development of most complex unit. All units in each architecture have the same production start (PRMTHS)

Production completion as recommended by PRICE 83B (PRMTHP)

Learning curve rate in accordance with PRICE 83B and as follows (LCURVE):

Quantity QTY	Assembly Description
1,000	50% mechanized insertion, wave solder, manual circuit test
2,000-10,000	90% mechanized insertion, wave solder, manual circuit test
11,000 up	90% mechanized insertion, wave solder, semi-auto circuit test

1978 economic dollars with no escalation (YEAR, ESC) (AF)

Projects management, documentation, special tools and test equipment, etc. as recommended automatically by PRICE 83B based on a consensus of experience (PROJCT, DATA, TLGTSN, SYSTEM, PPROJ, PDATA, PTLGTS all set to 1.0) (AF)

The following inputs were estimated by design engineers for each unit. A worksheet containing information for PRICE 83B inputs and other functional information was prepared for each unit by design engineers. See Appendix D.

Quantity per system (QTYSYS)
Total weight (WT)
Volume (VOL)

Mechanical/Structure:

Weight including heavy electrical items (WS)
Complexity factor, obtained from the PRICE 83B reference manual (MCPLXS)
Degree of new design (NEWST)
Amount of hardware repetition (DESRPE)

Electronics:

Portion of volume occupied by electronics (USEVOL)

Complexity factor for electronics was estimated using the PRICE 83B reference manual table for circuit functions (i.e., analog, digital, etc.) and technology (i.e., discrete, IC, etc.). Most units contained multiple circuit functions, and the PRICE PARASYN mode was used for these units (MCPLXE).

Degree of new design (NEWEL)

Amount of hardware repetition (DESRPE)

Average power dissipated (PWR)

Number of components (CMPNTS)

Engineering:

Engineering complexity ranking factor (ECMPL)

Numerical values used for each unique unit (or same unit with different quantitites that appears in one or more alternates) are contained in the PRICE 83B report. See Appendix F.

4.2.4 ACQUISITION COST RESULTS

Acquisition cost summaries for Architectures One (Dedicated) and Three (Integrated) are presented in Tables 4.2.4-1 and -2 respectively. All Architecture Three totals, subtotals, and cost elements are lower than Architecture One. The integrated acquisition costs are

Table 4.2.4-1. Acquisition Costs for Architecture One (Dedicated) ($1000)

TOTAL COST, WITH INTEGRATION COST

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	6578.	307.	6885.
DESIGN	27829.	922.	28751.
SYSTEMS	8948.	0.	8948.
PROJ MGMT	9114.	5711.	14825.
DATA	4056.	272.	4327.
SUBTOTAL(ENG)	56526.	7212.	63737.
MANUFACTURING			
PRODUCTION	0.	107024.	107024.
PROTOTYPE	6689.	0.	6689.
TOOL-TEST EQ	791.	3990.	4781.
PURCH ITEMS	0.	0.	0.
SUBTOTAL(MFG)	7480.	111014.	118494.
TOTAL COST	64006.	118225.	182231.
COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	54620.	93570.	148190.
CENTER	64006.	118225.	182231.
TO	77876.	156415.	234291.

EXCLUDES ANTENNAS

AAC037

Table 4.2.4-2. Acquisition Costs for Architecture Three (Integrated) ($1,000)

TOTAL COST, WITH INTEGRATION COST			
Program Cost	DEVELOPMENT	PRODUCTION	TOTAL COST
Engineering			
Drafting	1756.	159.	1915.
Design	6133.	488.	6621.
Systems	1071.	0	1071.
Proj Mgmt	1397.	5272.	6669.
Data	498.	247.	745.
Subtotal (Eng)	10855.	6166.	17021.
Manufacturing			
Production	0	86016.	86016.
Prototype	4918.	0	4918.
Tool-Test Eq	442.	13151.	13593.
Purch Items	0	0	0
Subtotal (Mfg)	5360.	99167.	104527.
Total Cost	16215.	105333.	121546.
Cost Ranges	DEVELOPMENT	PRODUCTION	TOTAL COST
From	13646.	83789.	97435.
Center	16215.	105333.	121546.
To	19817.	136928.	156745.
Excludes Antenna			

33 percent ($60,685,000) less than the dedicated. Major function costs for Architecture Three (RF, Processors, and Enclosures) are presented in Table 4.2.4-3. RF unit acquisition costs are almost seven times the Processor unit costs.

Appendices E and F contain acquisition costs for each unique unit (or same unit with different quantities). In these appendices Architectures One and Three are complete, whereas the units contained in the other architectures (two, six, and seven) are different units that will replace some of the units in Architectures One and Three. Complete Architectures Two, Six, and Seven include some units from One and Three.

Table 4.2.4-3. Architecture Three Major Function Costs
($1,000)

	RF	PROCESSORS	ENCLOSURES	SUBTOTAL
Development	14163.	1831.	224.	16218.
Production	92262.	10076.	2990.	105328.
Total	106425.	11907.	3214.	121546.
Excludes Antennas				

The results from Appendices E and F have been categorized and extrapolated in Section 3 so that acquisition costs are obtained for all seven architectures and for features (e.g., power supply, BITE, etc.) within each architecture.

4.3 SOFTWARE COSTS

Estimates of software development are done by PRICES.

4.3.1 PRICE S INPUTS AND OUTPUTS

Figure 4.3.1-1 is the PRICE S output for NBSP : GPS. The input data section lists all the parameters associated with the descriptive variables. It sets forth the total scope of work, resources, schedules and other significant factors. The costs, by work element, for each of the three development phases are shown in thousands of dollars under program costs.

The additional data section provides information to be used as reference values for the purpose of measuring the credibility and consistency of the input data. Proper use of such data minimizes the probability of using costs resulting from faulty inputs. Any such inputs entered as zero will be calculated and printed out in this section. For example, if schedules are not specified, the calculated schedules are shown in this section. The work load phasing between the three development activities is graphically depicted under schedule graph.

4.3.2 SOFTWARE INPUT DATA

The mandatory inputs for the PRICE Software Model include: the total number of executable machine-level instructions (INST), the application mix of instructions (APPL or MIX) which represents the inherent instruction complexity, resource (RESO) which relates the scope of the work to the shop doing the work, complexity (CPLX) which relates the difficulty of the task to the normal time required to perform the task, the

```
                         --- PRICE SOFTWARE MODEL ---

                     DATE 17-OCT-78      TIME 18:09

MFBARS                                                         NBSP:   GPS

                                 INPUT DATA
FILENAME: SMES2                                            DATED: 22 SEPT 78

DESCRIPTORS
   INSTRUCTIONS   20000        APPLICATION    0.000       RESOURCE       3.500
   FUNCTIONS          0        STRUCTURE      0.000       LEVEL          0.000

APPLICATION CATEGORIES          NEW DEVELOPMENT           SYSTEM CONFIGURATION
                    MIX         DESIGN        CODE         TYPES        QUANTITY
   DATA S/R         0.00        1.00          1.00           1              1
   ONLINE COMM      0.00        1.00          1.00           1              1
   REALTIME C&C     0.80        1.00          1.00           1              1
   INTERACTIVE      0.00        1.00          1.00           1              1
   MATHEMATICAL     0.20        1.00          1.00          ***            ***
   STRING MANIP     0.00        1.00          1.00          ***            ***
   OPR SYSTEMS      0.00        1.00          1.00          ***            ***

SCHEDULE
   COMPLEXITY       1.000
   DESIGN START     JAN 85      IMPL START       0        T&I START          0
   DESIGN END         0         IMPL END         0        T&I END            0

SUPPLEMENTAL INFORMATION
   YEAR             1978        ESCALATION     0.000      TECH IMP        1.00
   MULTIPLIER       1.500       PLATFORM       1.8        UTILIZATION     0.63

                                PROGRAM COSTS

COST ELEMENTS                       DESIGN       IMPL        T & I       TOTAL
   SYSTEMS ENGINEERING                315.         14.        258.        587.
   PROGRAMMING                         68.         77.        106.        250.
   CONFIGURATION CONTROL               52.         22.        170.        244.
   DOCUMENTATION                       52.          9.         79.        138.
   PROGRAM MANAGEMENT                  42.          7.         35.         84.
      TOTAL                           530.        127.        648.       1305.

                               ADDITIONAL DATA
DESCRIPTORS
   INSTRUCTIONS   20000        APPLICATION    6.941       RESOURCE       3.500
   FUNCTIONS        222        STRUCTURE      0.000       LEVEL          0.000

SCHEDULE
   COMPLEXITY       1.000
   DESIGN START     JAN 85      IMPL START     APR 85     T&I START     JUL 85
   DESIGN END       SEP 85      IMPL END       DEC 85     T&I END       JUL 86

                               SCHEDULE GRAPH
JAN 85                                                                  JUL 86
************ DESIGN ************
            ************ IMPLEMENT ************
                         ****************** TEST & INTEGRATE ******************
   AAC038
```

Figure 4.3.1-1. PRICE S Output Example – GPS Part of Narrowband Signal Processor

date design effort starts (DSTART), the reference point (YEAR) for both escalation (ESC) and technology improvement (TECIMP), the multiplier (MULT) which adjusts cost to include general and administrative expense and fee or profit, platform (PLTFM) which relates the cost of software development to the environment in which the software will operate, and utilization (UTIL) which is the fraction of the hardware speed and memory utilized.

Three separate MFBARS software functions were identified: Narrowband Signal Processor, Wide Band Signal Processor and Control Processor. The Narrowband Signal Processor was further delineated to GPS, SEEK TALK, Adaptive Antenna and Conventional Communications.

The number of executable machine-level instructions (INST), application mix of instructions (MIX), and the fraction of hardware speed and memory utilized (UTIL) were developed through interviews with the design engineer.

A typical value of 3.5 was used for RESO and 1.0 for CPLX. Design start was set at January 1985. Year was set to 1978 and ESC = 0 to develop costs in constant $1978. MULT was set to 1.5 which was a ground rule for the study. A PLATFM of 1.8 was used to reflect a MIL-Spec avionics environment for the software.

4.3.3 SOFTWARE COST RESULTS

Software costs for integrated architectures for each of the three software development phases are presented in Table 4.3.3-1. The total software cost is $8,369,000. No software costs are included in dedicated architectures, as there will be little software where there is mostly dedicated logic. Appendix G contains software cost detail. See Section 2.4.3.11(A) for associated discussion of software.

Table 4.3.3-1. Software Costs for Integrated Architectures ($1000)

	DESIGN	IMPLEMENT	TEST & INT	TOTAL
NBSP				
GPS	530	127	648	1305
SEEK TALK	264	63	318	645
Adap. Ant.	111	26	131	268
Conv. Comm.	94	18	109	221
WBSP	1098	253	1353	2704
Ctrl. Pro.	1298	299	1629	3226
TOTAL	3395	786	4188	8369

4.4 SUPPORT AND LIFE CYCLE COSTS

PRICE L1 computes support costs while operating in conjunction with PRICE 83B. This section includes the manner in which PRICE L1 was used for MFBARS evaluations and a summary of hardware support and life cycle costs for Architectures One (Dedicated) and Three (Integrated). Appendix G contains the full two page output (i.e., Figure 4.4.1-1 format) for each unique unit (or same unit with different quantities) that appears in Architectures One and Three.

4.4.1 PRICE L1 INPUTS AND OUTPUTS

The PRICE L1 input data file for each unit is generated automatically based on the acquisition cost file. Alternately, the input data file may be created or modified. Figure 4.4.1-1 is the PRICE L1 output for the GPS unit of MFBARS Architecture One. Sheet 1 is the input data file for the unit; sheet 2 is the basic output format; the top portion provides a summary of principal input data; the lower part provides various calculated values and detailed costs. Principal input data provided are: R&M data, including the LRU MTBF and the MTTR for LRUs and Modules; Deployment Data, including the number of Equipment, Organization, Intermediate and Depot maintenance locations; the number of LRUs per equipment, the number of module types per LRU, and the number of part types per LRU. Next provided are Employment Data, including the support period, hours of operation per month (the on-time fraction); global data including the number of supply locations at each level, the escalation rate in use, and the fraction of LRUs allowed to fail without degrading the system performance.

Calculated output begins with the line identifying the number of the maintenance concept determined by the model as most cost-effective. The next line describes that concept.

Program costs are presented for various cost elements in each of the development, production and support phases, and for the total program. The "EQUIPMENT" costs are the acquisition costs generated in PRICE, modified as required by learning curve and initial spares quantity. "OTHER" costs include the costs for programming and documenting the test equipment, spares and test equipment space, reorder burden, and transportation.

The remaining output data include values for the inherent and operational availability; the number of test sets used at each maintenance level, and their utilization fraction, and the required supply quantities, both initial and balance consumed, of LRUs, modules (per type) and parts (per type). The final portion of output, the Cost/Effectiveness List, rank orders the maintenance concepts by the ratio of total cost divided by operational availability, as compared to the most cost-effective concept.

4.4.2 USING PRICE L1 FOR MFBARS

PRICE L1 for support costs was similar to PRICE 83B for development and production costs in that some effort was required to structure PRICE L1 for MFBARS evaluations. Highlights of this activity are described.

```
                              PRICE LIFE CYCLE COST

MA100 GPS                                                              LC:   MC1EL

INPUT DATA

R&M DATA
  MTBF          183. MTTR-LRU         1.4  MTTR-MOD         2.5

DEPLOYMENT
  EQUIPS       1000. ORGANIZATION      0.   INTERMEDIATE    20.   DEPOT   1.
  LRUS/EQUIP      1. MODS/LRU         39.  PARTS/LRU      164.

EMPLOYMENT
SUPPORT PERIOD        10.                  HRS/MON        30.0  OTF     0.041

GLOBAL
  ECUSUP       1000. ORGSUP            0.   INTSUP          20.   DEPSUP  1.
  ESC         0.000 LRU FAIL ALLOW    0.

MAINTENANCE CONCEPT   3
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST           DEVELOPMENT     PRODUCTION        SUPPORT          TOTAL

  EQUIPMENT                17729.         23086.             0.          40815.
  SUPPORT EQUIP               0.          3259.          3259.           6518.
  MANPOWER                    0.             0.          1804.           1804.
  SUPPLY                      0.          3068.          5197.           8265.
  SUPPLY ADM.                 0.            12.           122.            134.
  CONTRACTOR SUPPORT          0.             0.             0.              0.
  OTHER                       0.             0.           577.            577.

      TOTAL COST           17729.         29425.         10960.          58114.


AVAILABILITY
INHERENT                      0.9688  OPERATIONAL                        0.9688

SUPPORT EQUIPMENT          ORG                INT               DEPOT
NO.                        0.                20.                1.
UTILIZATION                0.000              0.917             0.079

SUPPLY                    UNITS            MODULES            PARTS
INITIAL, PER TYPE         53.               28.               42.
BALANCE CONSUMED         126.964             0.000            74.017

COST EFFECTIVENESS LIST (%)
 24     100.0  14     653.1
```

AAC039-1

Figure 4.4.1-1. PRICE L1 Output Example – Architecture One, GPS Unit (Sheet 1 of 2)

```
MA100 GPS

DEPLOYMENT
EQUIPS(ED)     1000. ORGANIZATION(OD)    0. INTERMEDIATE(DI)  20. DEPOT(DD)  1.

DURATION OF SUPPORT PERIOD,YEARS(YR)              10.00
ON-TIME FRACTION(OTF)                               .041

LRU MTBF,HOURS(MTBF)                              183.
LRU REPAIR TIME,HOURS(TR)                           1.76
MODULE REPAIR TIME,HOURS(TMD)                       2.77
LRU PER SYSTEM,(EE)                                 1.
LRU COST,$(CUR)                                 21311.
MODULE COST,$(CMR)                               1156.96
PART COST,$(CPR)                                  144.62
PART COST ON-EQUIPMENT REPAIR,$(CPRE)             144.62
DEVELOPMENT COST,$(CEND)                      1773663.
NON-RECURRING PRODUCTION COST,$(CPE)           2104809.
CONTRACTOR LRU REPAIR COST,$(CUR)                1060.56
CONTRACTOR MODULE REPAIR COST,$(CMR)              404.94
MODULE TYPES, R                                    39.
PART TYPES, RP                                    154.
FRACTION NON-STD.PARTS,(FNSP)                       0.50
LRU SUPPORT EQPT. COST,$(CFIM)                 117199.
LRU+MODULE SUPPORT EQPT.,$(CFIP)               145147.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)                  2.49
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)           3.14


COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT EUP         0.879   MODULE(EMP)        0.939  PART EPP          0.970

REFERENCE QUANTITIES:
UNIT(RNU       1000.       MODULE(RNM)     1000.      PART(RNP        100.

SHIPPING WEIGHT, POUNDS:
UNIT WU          50.0      MODULE(WM)          0.64  PART WP           0.080

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU)       0.316    MODULE(CUBEM)      0.015  PART(CUBEP)       0.0019

DEVELOPMENT PHASE, YEARS (YD)                  2.57
PRODUCTION PHASE, YEARS (YP)                   2.95
```

AAC039-2

Figure 4.4.1-1. PRICE L1 Output Example – Architecture One, GPS Unit (Sheet 2 of 2)

4.4.2.1 MTBF ADJUSTMENT – It is necessary to adjust the Mean Time Between Failure (MTBF) calculated automatically by the PRICE L1 model. (This MTBF is for repair actions and is not relevant to mission reliability where redundancy is present.) Say a larger LRU with a 10-pound electronics weight is divided into ten smaller LRUs, each with a one-pound electronic weight. The electronic complexity of the large and each of the smaller units is identical. The large unit contains the identical circuitry of the small unit repeated ten times. The PRICE L1 model will calculate a MTBF of 918 hours for the large unit and a MTBF of 316 hours for all ten smaller units where the complexity factor MCPLXE is 8.1. As MTBF is a support cost driver, this has the effect of penalizing smaller LRUs. However, reliability modeling says that the MTBF of the ten identical small units in series is the same as the MTBF of the large unit.

PRICE L1 MTBF for electromechanical items with a platform PLTFM less than two and a weight of electronics WE less than 940 pounds is:

$$\text{MTBF} = \frac{-2724 - 6079.104\ \text{MCPLXE} + 3877.296\ \text{MCPLXE}^2}{(2.41 - 2.25\ \text{PLTFM} + 1.094\ \text{PLTFM}^2)^{3.6}(6.328\ \text{WE}^{0.535})}$$

where the circuit complexity MCPLXE is obtained using PRICE 83B handbook tables. Failure rate is 1/MTFB and is shown in Figure 4.4.2.1-1 as a function of WE using the PRICE L1 model.

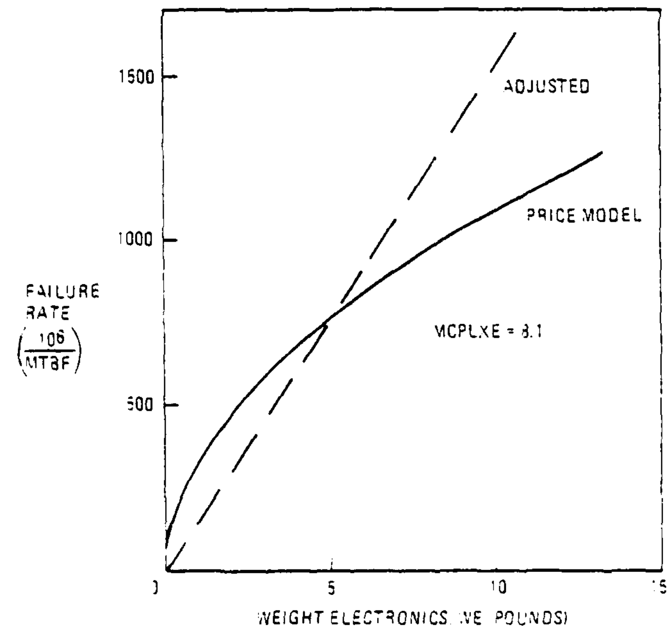

Figure 4.4.2.1-1. Adjusted Failure Rate Relationships

The PRICE L1 MTBF model is adjusted to conform with conventional reliability modeling by making failure rate a linear function of WE. A weight of electronics of five pounds, (which is an approximate midpoint value for all Architecture One (Dedicated) and Three (Integrated) units considered in this MFBARS study) is used to establish the slope of the linear function. The adjusted MTBF model is:

$$\text{Adjusted MTBF} = \frac{(2724 \quad 6079.104\ \text{MCPLXE} + 3877.296\ \text{MCPLXE}^2)}{(2.41 \quad 2.25\ \text{PLTFM} + 1.094\ \text{PLTFM}^2)^{3.6}(6.328)\ (.473128\ \text{WE})}$$

See Figure 4.4.2.1-1.

4.4.2.2 SMALL UNIT SPECIAL HANDLING – The maintenance concept for all units except antennas is the least costly of: (1) throwaway, or (2) 95% repair to piece-part at intermediate, 1% scrap at intermediate, and 4% repair to piece-part at depot. The maintenance concept for antennas is similar except that there is 50% repair at intermediate and 50% scrap at intermediate.

MFBARS Architectures Three, Four, Five, Six and Seven contain small units, e.g., total weight of one pound, which are designed for removal and replacement on an aircraft. PRICE L1 would not process these units as LRUs because PRICE L1 estimated there was only one module type (P = 1). In order to process these small units, PRICE L1 module maintenance concepts are used for them, whereas LRU concepts are used for larger units.

Standard PRICE L1 maintenance concepts used are as follows:

- Electronic units with more than one PRICE L1 module:

  100% 1. LRU discard at failure

  or

  95% 7. Repair LRU to piece-part at intermediate

  1% Scrap

  4% 9. Repair LRU to piece part at Depot

- Electronic units with one PRICE L1 module:

  100% 11. One-equipment repair to module. Module discard.

  or

  95% 13. On-equipment repair to module. Module repair at Intermediate.

  10% Scrap

  4% 14. On-equipment repair to module. Module repair at depot.

- Antennas:

  100% 1. LRU discard at failure.

  or

  50% 7. Repair LRU to piece-part at Intermediate.

  50% Scrap

4.4.2.3 LARGE PRODUCTION QUANTITY EFFECTS – In order to better understand PRICE L1 a sensitivity study was made for the effects of large quantity differences. A representative item from an integrated architecture (architecture three, MA300 RF MOD20 VHF FM TRAN) was used. Table 4.4.2.3-1 presents the effects on major cost elements for total quantities from 1000 to 100,000. Total support cost expressed as a percentage of total life cycle cost varies from a maximum of 54 to a minimum of 24. The minimum of 24 percent is apparently a constant percentage for large quantities starting somewhere around 30,000 to 40,000 total quantity. Note that total support cost, although a significant percentage, is not in the order of, say, five to ten times development and production cost. The expression that support costs are ten times development and production cost is heard often.

The reason that total support costs are not very large for MFBARS is because the support period is only ten years and the on-time is only 30 hours monthly.

Support costs in the tables are for the 95% intermediate repair, 1% scrap, and 4% depot maintenance concept. Table 4.4.2.3-2 presents the subelements for total support cost. Note that support equipment cost is fixed until a total quantity in excess of 50,000; there is no saving until a very large quantity is reached. Manpower cost is essentially proportionate to total quantity; there is no saving with very large quantity. Some savings are achieved with spares for large quantities, but this reaches the start of saturation for large quantities for a total quantity somewhere less than 10,000 units. It seems there should be more spares savings for very large quantities. This will be studied further in Phase II.

4.4.3 SUPPORT INPUT DATA GROUND RULES

Support costs and a total life cycle cost are computed by PRICE L1. Inputs to the PRICE L1 are described below:

1000 installations (ED) (AF)

No organization maintenance locations (OD)

20 intermediate maintenance locations (DI)

2 depot maintenance locations (DD)

10 years in the support phase (YR) (AF)

30 hours per month operation (ONTIME)

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MULTIFUNCTION MULTIBAND AIRBORNE RADIO SYSTEM MFBARS.(U)
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3 OF 6
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Table 4.4.2.3-1. Life Cycle Cost Element Sensitivity to Total Quantity
($1000)

Total Quantity (QTY) / Qty. per System (QTYSYS)	1,000 / 1		10,000 / 10		20,000 / 20		50,000 / 50		100,000 / 100	
	$	%	$	%	$	%	$	%	$	%
Development	$ 279	8	$ 651	6	$ 1,040	6	$ 2,167	6	$ 3,997	6
Production	1,404	38	7,110	65	11,559	67	24,815	70	46,677	70
Total Support	1,979	54	3,198	29	4,561	27	8,490	24	16,103	24
Total	$3,662		$10,959		$17,160		$35,472		$66,777	

Table 4.4.2.3-2. Support Cost Element Sensitivity to Total Quantity
($1000)

Total Quantity (QTY) / Quantity per System (QTYSYS)	1,000 / 1		10,000 / 10		20,000 / 20		50,000 / 50		100,000 / 100	
	$	%	$	%	$	%	$	%	$	%
Support Equipment	$1,664	83	$1,664	52	$1,664	36	$1,664	20	$ 3,177	20
Manpower	111	6	1,103	34	2,198	48	5,438	64	10,700	66
Supply	170	9	382	12	633	14	1,272	15	2,024	13
Other	34	2	49	2	66	2	116	1	201	1
Total Support	$1,979		$3,198		$4,561		$8,490		$16,103	
$\frac{\text{Supply}}{\text{Production}} \times 100$	12.1		5.4		5.4		5.1		4.3	

Abbreviations in parenthesis are the PRICE L variable identification. Presence of (AF) along with the abbreviation indicates that the value used was based on information provided by the Air Force MFBARS program office or obtained from the user's manual for the Air Force Logistics Support Cost model.

PRICE L1 has a large number of variables (globals) to enable the model to represent the support plan envisioned. Values used are described below, otherwise standard PRICE L1 values assigned by the program are used:

Spares at intermediate and depot (HE = 0, HO = 0, HI = 1, HD = 1)

Depot LRU float spares factor (ZUD = 3)

Depot module float spares factor (ZUM = 3)

Intermediate repair turnaround time (TIO = 3.95 days) (AF)

Depot shipping time to intermediate using float spares (TDI = 13.9 days) (AF)

On equipment and intermediate maintenance hourly labor rate (CUCE = CUFE CUFE = CUI = $16.42) (AF)

Depot maintenance hourly labor rate (CUD = 32.62) (AF)

LRUs scraped at intermediate (SUI = .0104 for electronics, SUI = .5 for antennas)

Modules scraped at intermediate (SMI = .0104 for electronics, SUI = .5 for antennas)

Maintenance concept variables used for PRICE L1 are as follows:

Electronic units with more than one PRICE L1 module:

(MC = 1, 2, 0,

G1 = 1., 19 * 0.,

G2 = 17 * 0., .96, 0., .04,)

Electronic units with one PRICE L1 module:

(MC = 1, 2, 0,

G1 = 2 * 0., 1., 17 * 0.,

G2 = 9 * 0., .96, .04, 9 * 0.,)

Antennas:

(MC = 1, 2, 0,

G1 = 1., 19 * 0.,

G2 = 17 * 0., 1., 2 * 0.,)

The input data file (see Figure 4.4.1-1, sheet 1) for each unit was generated automatically. The only modification was the MTBF value as discussed in Section 4.4.2.1.

4.4.4 SUPPORT COST RESULTS

Support and Life Cycle Cost summaries for Architecture One (Dedicated) and Three (Integrated) are presented in Tables 4.4.4-1 and -2 respectively. All Architecture Three totals, subtotals, and cost elements are less than Architecture One. The integrated hardware life cycle costs are 39 percent ($104,722,000) less than the dedicated. The integrated total support costs (hardware life cycle costs less acquisition costs) are 48 percent ($41,701,000) less than the dedicated.

Appendix H contains support and life cycle cost for each unit in Architectures One and Three. The results from Appendix H have been categorized and extrapolated in Section 3 so that support costs are obtained for all seven architectures and for features (e.g., power supply, BITE, etc.) within each architecture.

4.5 OPERATIONAL READINESS AND MISSION RELIABILITY

Operational Readiness (OR) and Mission Reliability (MR) will be calculated for the different MFBARS architectures during Phase II. The input data developed for the life cycle cost evaluation also provides the input data required for evaluation of OR and MR. Computations will be performed using an existing GDE in-house model. Some preliminary runs for the purpose of structuring the analysis have been run for a dedicated architecture.

4.5.1 COST-AVAILABILITY-SPARES MODEL

The GDE in-house Cost-Availability-Spares model is a general-purpose model that has been used on most major contracts and proposals at GDE. The model for determining Life Cycle Cost (LCC), Reliability-Availability-Maintainability (RAM), and Spares optimization. The model may be used to calculate a total life cycle cost for any level of hardware (system, subsystem, assembly, etc.). As such, it may be used to conduct cost trade-off studies. Since the model contains maintenance cost features, it can be used to optimize the maintenance concept. It also includes a discard feature, allowing comparison of discard vs. repair-at-failure. Sensitivity and interaction analyses are readily performed in order to investigate the effects of variations of operational, reliability, maintainability, and logistics parameters on LCC, RAM, and Spares.

The LCC model is a combination of direct cost estimate bookkeeping and of cost estimating relationships (CERs) for generating parametric cost estimates. Yearly costs are estimated for each cost category. Costs for major cost categories and total LCC are calculated in constant, inflated, and discounted dollars. Spares quantities are calculated optimally (minimize cost for a given spares outage probability) for multiple locations. Reliability, availability, and maintainability parameters are calculated by selecting the appropriate model for the particular application. The flow diagram presented in Figure 4.5.1-1 illustrates this model.

MFBARS evaluation will use Reliability-Availability-Maintainability and Spares features of the model. As life cycle cost is obtained using the PRICE models there is no plan to use this feature of the GDE model. However, in the event there is any need, the Life Cycle Cost feature of the GDE model can readily be used.

Table 4.4.4-1. Support and Life Cycle Costs for Architecture One ($1000)

PRICE LIFE CYCLE COST

SYSTEM TOTALS

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	64006.	117421.	0.	181427.
SUPPORT EQUIP	0.	26374.	26374.	52749.
MANPOWER	0.	0.	7012.	7012.
SUPPLY	0.	14689.	9978.	24667.
SUPPLY ADM.	0.	112.	1123.	1235.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	1322.	1322.
TOTAL COST	64006.	158596.	45810.	268412.

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Table 4.4.4-2. Support and Life Cycle Costs for Architecture Three ($1000)

SYSTEM TOTALS PROGRAM COSTS	PRICE LIFE CYCLE COST			
	DEVELOP-MENT	PRODUC-TION	SUPPORT	TOTAL
Equipment	16278	102128	0	118406
Support Equip	0	9301	9301	18602
Manpower	0	0	5054	5054
Supply	0	12039	9048	21087
Supply Adm.	0	37	372	409
Contractor Support	0	0	0	0
Other	0	0	132	132
TOTAL COST	16278	123505	23907	163,690

4.5.2 OPERATIONS AND MAINTENANCE CONDITIONS

Outlined below are the operations and maintenance conditions for the OR and MR evaluations. The operations conditions are for representative Air Force tactical aircraft and will be used for each MFBARS architecture. The maintenance conditions are also for representative Air Force tactical aircraft. It is possible that somewhat different maintenance conditions may be better suited for some MFBARS architectures or there may be interest in other concepts. Changes can readily be made.

Operations Conditions

a. There are 50 aircraft at one base.

b. The typical aircraft mission time is one hour. Two-hour missions will also be analyzed.

c. Each aircraft will be used 30 hours monthly.

Maintenance Conditions:

a. Preflight checkout of the CNI avionics is done using BITE.

b. A failed LRU on an aircraft is exchanged, requiring a short time. Spare LRUs are carried at the base.

c. A failed LRU is repaired at the aircraft base for most units. Some units are scraped. Turnaround time is 3.95 days (from AFLC Logistics Support Cost Model).

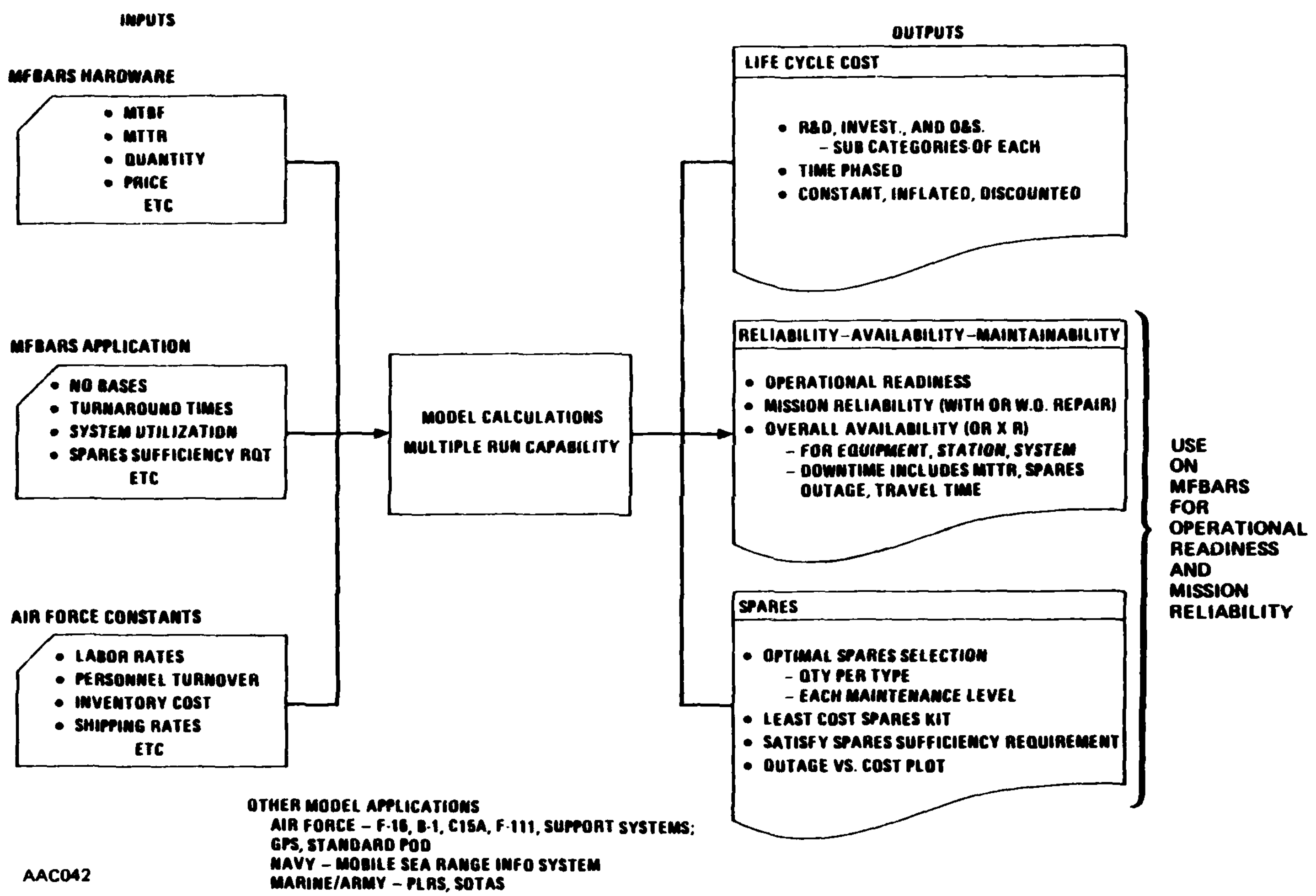


Figure 4.5.1-1. GDED In-House Cost-Availability-Spares Model

d. The base test equipment is primarily Automatic Test Equipment (ATE), requiring new test adaptors and software test programs for new LRUs. There may be Special Test Equipment for some LRUs.

e. Failed LRUs not repairable at a base are sent to the designated depot for repair. The depot will carry float spare LRUs for exchange with failed items. Order and shipping time is 13.9 days and depot repair cycle time is 56 days (from AFLC Logistics Support Cost Model).

f. A single depot will support ten bases.

4.5.3 OPERATIONAL READINESS

Operational Readiness (OR) is the probability (i.e., the fraction of time) that the CNI avionics on all (or some lesser quantity) of the 50 aircraft at a base are operational at any time prior to the start of a mission. The dominant maintenance consideration for tactical aircraft OR is the availability of a spare LRU at the base when needed. A failed LRU on a tactical aircraft is typically removed and replaced in a short elapsed time, e.g., several minutes. The OR measure for MFBARS will be base spares sufficiency. Spares sufficiency will be computed for each LRU using base and depot spares quantities and standard AF logistics turnaround times. Spares sufficiency for all LRUs and all aircraft is computed from the individual LRU sufficiencies. The Operations and Maintenance Conditions will be used for estimating OR.

An illustration of the OR of the CNI avionics on the aircraft at a base is presented in Figure 4.5.3-1; OR for three spares levels (low, nominal, high) are shown. Specific spares kits (i.e., the number of spares of each individual LRU at each base and at the depot) are determined optimally by the GDE model. Spares quantities are selected based on Mean Time Between Failure (MTBF) and cost. That is, the spares kit that will maximize OR is selected for a given total spares cost. Figure 4.5.3-1 indicates the fraction of the time that the CNI avionics on all 50 aircraft are OR. More importantly, also indicated are the quantity of aircraft that are nearly always OR, i.e., .9999 of the time. Sensitivity of the OR to MTBF and to the fraction of LRUs not repairable at a base will also be determined. MTBF is a measure of the reliability designed and manufactured into the CNI avionics and the fraction not repairable is a measure of the base maintenance capability.

Similar OR calculations will be performed for each MFBARS architecture.

4.5.4 MISSION RELIABILITY

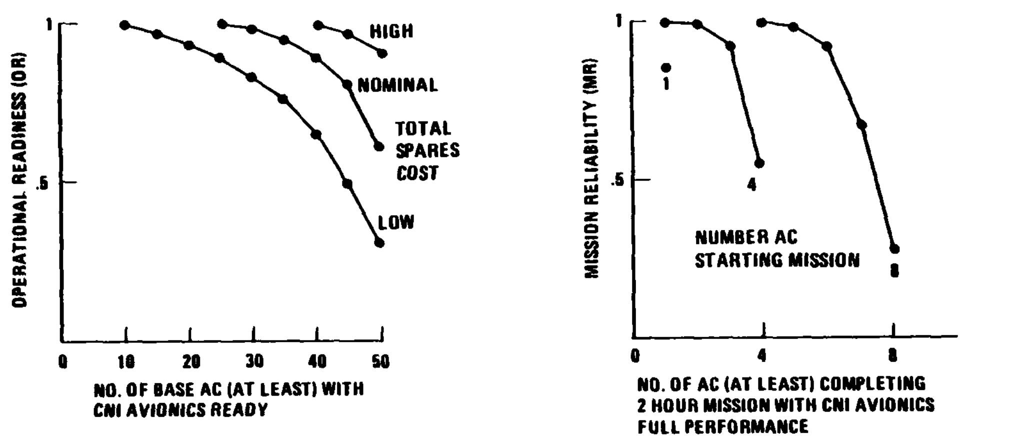
Reliability is the probability (i.e., the fraction of missions) that the CNI avionics will not fail during a mission where there is no repair during a mission. A typical aircraft mission is one hour and longer missions of two hours will also be considered. Tactical aircraft typically operate in groups and the reliability of multi-aircraft missions will be considered. For integrated architectures it is very important to evaluate the effects of single failure points and redundancy, as multiple functions may be affected by a single hardware item. A failure of a CNI function in a dedicated architecture results only in the loss of that function. Hence, different reliabilities for different performance levels (i.e., function mixes) will be considered.

OR IS THE FRACTION OF TIME THAT THE CNI AVIONICS ON A GIVEN NUMBER OF THE 50 AIRCRAFT AT A BASE ARE OPERATIONAL AT ANY TIME

MR IS THE FRACTION OF MISSIONS DURING WHICH THE CNI AVIONICS ON A GIVEN NUMBER OF MISSION AIRCRAFT WILL NOT FAIL

FORMAT ILLUSTRATION, HYPOTHETICAL DATA

FORMAT ILLUSTRATION, HYPOTHETICAL DATA



ALSO WILL DO SIMILAR RUNS FOR OTHER CONDITIONS, E.G., MR FOR REDUCED PERFORMANCE, 1 HOUR MISSION, ETC.

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Figure 4.5.3-1. Operational Readiness And Mission Reliability for Tactical Aircraft CNI Functions

The reliability block diagram for a dedicated architecture for full performance is a straightforward series system where all functions must perform (see Figure 4.5.4-1). The reliability diagram for reduced performance is also presented in Figure 4.5.4-1. Some functions may fail, i.e., there is redundancy, and some functions are considered nonessential.

An illustration of mission reliabilities of CNI avionics is presented in Figure 4.5.3-1. Mission reliabilities for full performance during two hour missions are shown for a single aircraft as well as for multi-aircraft operating simultaneously. Similar mission reliabilities will be calculated for each MFBARS architecture.

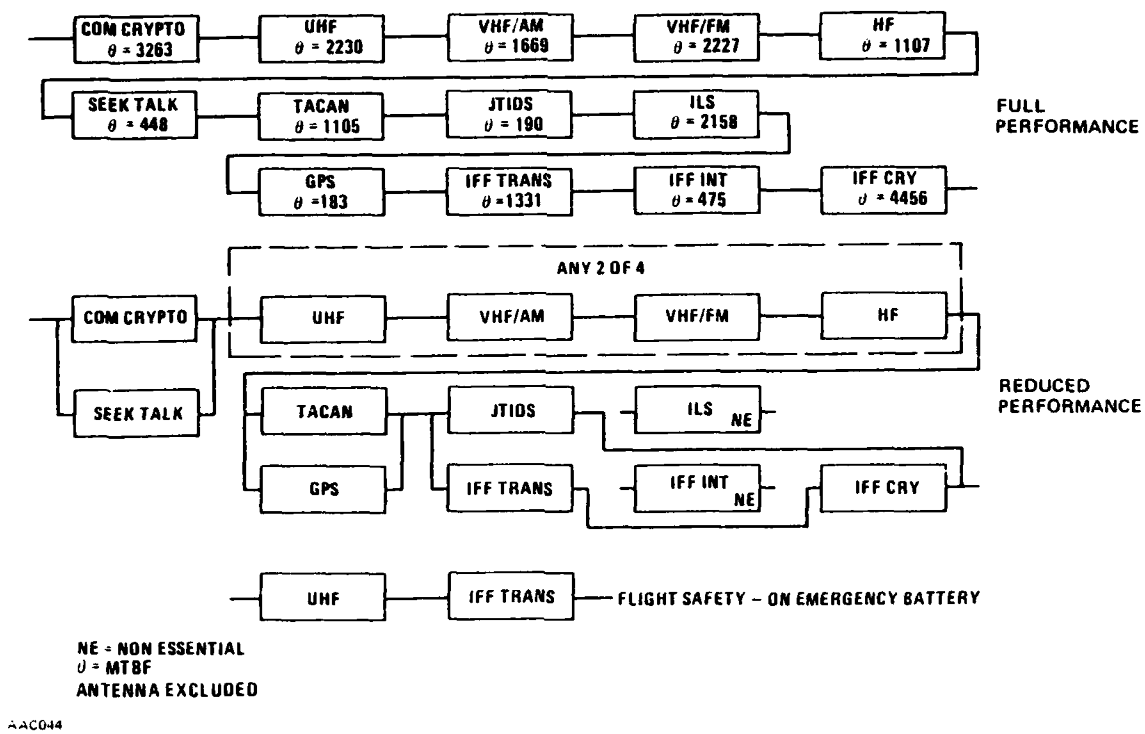


Figure 4.5.4-1. Dedicated Architecture Reliability Block Diagram

5. RECOMMENDATIONS FOR THE NEXT STUDY PHASE

The tasks accomplished during the Phase I study provide a very good basis for performing the next phase of the MFBARS study. A preliminary functional partitioning to a module level was established for the purpose of using the LCC economic analysis models. This partitioning will provide a starting point for more detailed trade-off analysis during the next MFBARS phase.

The successful use of the PRICE and LSC/RLA economic analysis models during the first study phase provides the basis for the economic analysis support of the more detailed trade-off analyses to be performed during the next study phase. We recommend using the PRICE and LSC/RLA during the next phase. We feel that we have solved all of the major problems associated with the initial application of these models during the very early definition phases of such a study program and that they will continue to be valuable for the comparative (but not absolute) LCC analyses for the next phase. We also recommend that a simple preprocessor be developed to make the transition from engineering type descriptions of hardware to the particular variable values required for input to the PRICE models easier. The development of this preprocessor is not critical to the successful completion of the next phase but it will make the use of the PRICE models more efficient. The preprocessor algorithms will be based on "rules-of-thumb" and the experience we gained during the first phase of the study.

We recommend that no changes be made to the existing Statement of Work (SOW) for the next phase. It is a well planned study phase which will provide the necessary design detail to support an orderly transition to the ADM phase of the MFBARS program. The existing SOW also provides for a degree of demonstration of the advantages and disadvantages of applying the integrated approach to specific AF tactical aircraft. As a result of our experience in discussing the application of MFBARS to the F-16 with our Fort Worth division during the first phase, we recommend that continued special emphasis be devoted to the demonstration of the advantages and disadvantages. Operational mission scenarios should be considered in detail.

The following paragraphs of this section discuss in more detail our recommendations for the next phase. The numbers in parenthesis following the title of each section refer to the current SOW paragraph numbers.

5.1 PRELIMINARY DESIGN (4.3.1)

We propose to start the next phase with three parallel tasks:

a. Packaging and partitioning studies,
b. Tactical aircraft mission operational CNI requirements analysis,
c. Economic analysis model improvements.

The packaging and partitioning studies will further define the selected architecture. The packaging and partitioning studies must be performed together because the most important issue to be resolved is module size. Small modules have the advantage of

being thrown away for maintenance but will result in larger overall unit size and weight. A best compromise must be selected. The module sizes assumed for the Phase I study may not be optimum. Module size also affects partitioning efficiency such as the number of interconnections, EMI and control.

Packaging studies will further examine current standardization efforts and in particular the applicability of the Hughes F-15 radar type packaging. The integral rack concept which allows replacement of modules on the flight line will be considered.

Partitioning trade-off studies will in particular be concerned with the distribution of BITE, electrical power conditioning and control functions within the MFBARS architecture. Data rates on the control/data buses will be detailed. The handling of secure data via the DAIS interface and the partitioning of data processing between MFBARS and DAIS must be studied in more detail.

Tactical missions and operations will be looked at to determine CNI requirements and how MFBARS can be best integrated into aircraft missions and operations. We recommend that there be more active Air Force efforts in assisting us in arranging working sessions with TAC, tactical aircraft SPOs and airframe manufacturers. These working sessions should be an opportunity to present to the participants our concepts of MFBARS and to get comments from these potential users.

The third initial task for the next phase will be to improve the method of providing inputs to the PRICE economic analysis models. Our experience with these models during Phase I will allow us to design a simple preprocessor computer program to convert from engineering type descriptions to PRICE type input data. This will be much more efficient and can provide a printed output of descriptive data in an improved format.

Prior to the design review we will develop MFBARS configurations for those aircraft for which we were able to determine CNI requirements for different missions. We recommend that advanced sessions of the F-16 be one of the aircraft studied because of its small size which causes special problems in the areas of antenna locations and avionics equipment space. A reference for the comparison to determine MFBARS advantages and disadvantages would be the CNI subsystem currently proposed for the aircraft types and missions studied. Mission effectiveness will be assessed for each aircraft studied using an existing GDE computer program.

At the Preliminary Design Review we expect to present results of the following tasks or studies:

a. Packaging and partitioning study

b. Preliminary design

c. Tactical aircraft mission and operational CNI requirements definition and demonstration of MFBARS applications

d. A preprocessor computer program for translation of input data to the PRICE models

5.2 DETAILED DESIGN AND ANALYSIS (4.3.2)

After the Preliminary Design Review the detailed design and analysis will start. The detailed design will use the results of the preliminary design for module size and type. Also, initial partitioning of functions to modules from the predesign studies will be used to start the detailed design of each module. One result of the detailed design will be a set of form, fit and function specifications, one for each different module type. Another result will be the description of one way of implementing the design for each of the modules. This description will list all assumptions made of technology advancement that is required and will assure that there is one way of implementing each module.

One of the most important considerations during detailed design is the degree of reprogrammability that is cost-effective. The optimum degree of reprogrammability needs to be determined for maximizing the use of common modules and for maximizing flexibility to adapt to new missions, new jamming threats or new CNI functions. Trade-off studies considering LCC will be performed to assure that the reprogrammability features do not become too expensive.

Fault tolerance will be provided for, as determined by our analysis of actual mission and operational requirements during both the preliminary design and the detailed design to assure that realistic provisions are made for the required reliability and vulnerability.

As the detailed module design progresses we will periodically update configuration designs that show the application of the modules to selected aircraft and mission combinations. This will assure that the for actual applications and reasonable growth options.

5.3 SPECIAL STUDIES

The marriage of standard digital net protocol with multifunctional avionics hardware under computer control affords the opportunity to reduce hardware costs and increases mission effectiveness far beyond what can be accomplished with the hardware improvement alone.

With such a marriage it is possible to envision totally different roles for receiving and transmitting capability. These roles would be quite similar to those found in the electronic warfare avionics. That is, the system might be structured to include three basic parts:

a. A "call" receiver which would function similarly to the EW intercept receiver

b. A dedicated receiver which would handle traffic of long duration

c. A dedicated transmitter which would handle both short and long duration traffic similar to repeat and continuous jamming

It appears that the key element to implementing such a system is establishment of net protocol which would include conversion of most information into digital format and inclusion of both address and priority within the message structure.

With such an implementation it is possible to envision many cost- and mission-effective changes, some of which are:

a. The use of the Call (or interrupt) receiver to:

   Scan the spectrum for activity
   Examine the activity for address
   Sort properly addressed messages for priority
   Examine the messages for desired response
   Initiate automatic responses
   Assign the dedicated receiver where long traffic is involved

b. The use of the dedicated receiver to:

   Handle messages of long duration

c. The use of the transmitter for both long and short transmissions

d. The interaction of alphanumeric displays and speech synthesizers having local mass memory vocabulary addressed by short digital words.

There are obviously many questions which need to be answered relative to the net protocol including acquisition concept, spoof protection, backward compatibility message structure, etc., and because of this it was impossible to assess the impact on cost- and mission-effectiveness of this concept within the limited time and budget available for MFBARS. It is felt, however, that standard digital net protocol would be a necessary ingredient to make full use of the MFBARS concept and should be a subject for a separate study contract.

6. CONCLUSIONS

The major conclusion indicated by our Phase I study tasks is that the MFBARS integration approach to CNI for Air Force tactical fighter aircraft is cost-effective and that our Architecture No. 6 should be designed in more detail to further demonstrate its advantages. We feel confident that the level of detail of our LCC comparisons of the baseline nonintegrated with the integrated architectures makes the results valid for comparison purposes.

Another conclusion from the Phase I study is that the PRICE models can be made effective for use in the definition and very early design phases of a program such as MFBARS where future rather than current technology is to be used. We feel that we have solved the major problems associated with such an application of the PRICE models and that they can be used in the next phase of the MFBARS program. We know of no better approach to the economic analysis.

We also can conclude that, in order to properly execute the tasks required in the next phase, it will be necessary to put special emphasis on establishing the CNI mission requirements for tactical aircraft in the 1990s. It will not be possible to arrive at a definite, specific set of requirements directly. Instead, we need to determine the direction technology and new developments are going. Then we must assure that the MFBARS can readily accommodate these new functions. For example, we must follow the NATO Identification System developments. Special data links are another new future function that will be needed. Other advanced requirements must be identified as early as possible in the next phase by contacting TAC, aircraft SPOs and other Air Force organizations in addition to the aircraft manufacturers.

APPENDIX A

OPTIMUM IF FREQUENCY FOR OCTAVE TUNING

APPENDIX A

OPTIMUM IF FREQUENCY FOR OCTAVE TUNING

For a receiver having an octave input tuning range, the optimum LO/RF occurs when the ratio is as high as possible (LO > > RF). Under these conditions the major spurious responses occur at frequencies which are submultiples of the IF frequency and assuming a balanced mixer is used in the receiver they are readily rejected. This very high LO to RF ratio causes other problems when the receiver frequency is high not the least of which is cost. As the ratio is decreased spurious responses get worse and when the ratio of LO to RF at the high end of the tuning band reaches 5.25 then there is another ratio at 1.215 which provides equal performance. For a receiver having a highest receiver frequency of 1600 MHz the very high LO frequency must be above 8.4 GHz with a first IF frequency above 6.8 GHz. These frequencies will be costly to implement and will suffer performance degradation.

The ratio of 1.213 requires a maximum LO frequency of 1944 MHz and IF frequency of 344 MHz. Decreasing the ratio toward 1.2 causes a 9th and 13th order spurious to be inband and increases the image rejection problem. Increasing the ratio causes 3rd, 7th, 8th, 12th and 13th order responses to appear at a LO/RF ratio of 1.5. Thus it appears that for a very high frequency receiver covering an octave band the most practical LO/RF ratio varies from 1.43 to 1.215 as the band is tuned.

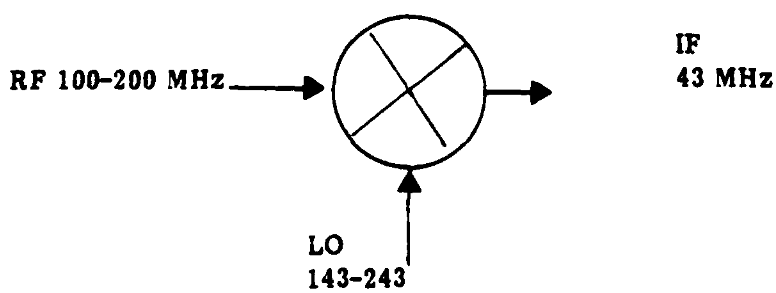
Spurious performance was measured by weighted summation of all spurious responses of order 15 or less according to the following formula:

(16-N) 6 for N with no even terms
(16-N) 6-20 for N with 1 even term
(16-N) 6-40 for N with 2 even terms and feedthrough spurs

This weighting assumes that double balanced mixers will be used in all conversions.

To insure good image rejection the LO frequency shall be at least 1.2 times the RF frequency.

Examination of a specific octave frequency band.



Spurious	Order	RF	LO
4 RF - 3 LO	7th	172 MHz	215 MHz
5 LO - 6 RF	11th	172 MHz	215
8 RF - 6 LO	14th	150.5	193.5
3 RF - 2 LO	5th	129	172
4 LO - 5 R	9th	129	172
7 RF - 5 LO	12th	129	172
6 RF - 4 LO	10th	107.5	150.5
6 LO - 8 RF	14th	107.5	150.5
9 RF - 6 LO	15th	100.33	143.33

It is noted that frequency bands around five specific frequencies will be bothered by spurious. Of these, three frequencies involve only very high order responses (10th or higher) and have an even order component in their product. It is anticipated therefore that only two frequency bands will be bothered by spurious response problems that occur at 1.29 and 1.72 times the lowest frequency.

Given the following division of the frequency band.

100-200 MHz
200-400 MHz
400-800 MHz
800-1600 MHz

The following frequency bands will have spurious responses.

129, 172 MHz
258, 344 MHz
516, 688 MHz
1032, 1376 MHz

It is feasible that if these spurious are bothersome that the first IF frequency and second LO frequency can be stopped to avoid spurious problem. This seems to be a drastic solution if several different bandwidths are required in the first IF.

After establishing the first IF frequencies it is appropriate to consider the spurious which would occur in converting to a common 70 MHz second IF.

Mixer Spurious Check - 2nd Conversion

RF-Freq	1st LO	1st IF	2nd LO	2nd IF	Nearby Spurious	Case #
100-200	143-243	43	113	70	4R-L at +2.75 MHz	1
					7R-2L at -0.7 MHz	2
200-400	286-486	86	156	70	8R-4L at +0.7 MHz	3
					6R-3L at +3.6 MHz	4
400-800	572-972	172	242	70	3R-2L at +12.7 MHz	5
					6R-4L at -0.3 MHz	6
800-1600	1144-1944	344	414	70	5R-4L at +1.2 MHz	7
					4R-3L at -16 MHz	8
2-100	145-243	143	213	70	2R-L at +3 MHz	

Spurious Response Check - 2nd Conversion

Case #1

RF Band 100-200 MHz

First IF 43 MHz

Second IF 70 MHz

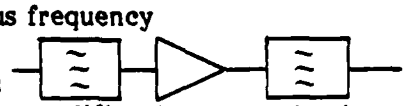
Spurious Source 4R-L = 79 MHz

Spurious Frequency $= \frac{183}{4} =$ 45.75 MHz in 1st IF

$= f_c -$ 2.75 MHz in RF Amplifier

Assumptions

1) First IF passes spurious frequency

2) First IF is of the form  and 2R, 3R, 4R terms generated in the amplifier do not reach mixer

3) Net gain prior to mixer is 21 dB and front end NF is 3 dB

4) Minimum predetection BW is 1 kHz

∴ Predetection BW noise power at input to mixer is -120 dBm

5) High level mixer is used with intercept point of +24 dBm at output (+30 dBM at input)

Conclusions

An interfering signal at 35 dB below the IM intercept point will produce a 4R-L product a -120 dBm level at the mixer input.

The receiver will handle a -26 dBm interfering signal at the front end with 3 dB loss of sensitivity. This signal is 115 dB above the front end noise power in a 1K Hz BW.

115 dB I/N Ratio

Spurious Response Check - 2nd Conversion Case #2

RF Band 100-200

First IF 43

2nd LO 113

2nd IF 70

Spurious Source 7R - 2L = 70 MHz

Spurious Frequency = 296/7 = 42.28 MHz in 1st IF

= f_c + .72 MHz at RF

Assumptions: Same as Case #1

Conclusions

For a 7R-2L product a signal 25 dB below the IMD intercept point will produce a product at -120 dBm at the input to the mixer.

The receiver will handle an interfering signal of -16 dBM with 3 dB loss of sensitivity. This signal is 125 dB above the front end noise power in a 1 kHz band.

125 dB I/N Ratio

Spurious Response Check - 2nd Conversion Case #3

RF Band 200-400

First IF 86

2nd LO 156

2nd IF 70

Spurious Source 8R-4L

Spurious Frequency = 694/8 = 86.75 in IF
= f_c -.75 at RF

<u>Assumptions</u> Same as Case #1

<u>Conclusions</u>

The high order of this product and the fact that only even order terms are involved indicates that a I/N Ratio of greater than 130 dB in a 1 kHz Bus can be tolerated. Sensitization of the front end due to limiting will be the main problem.

130 dB I/N ratio

Spurious Response Check - 2nd Conversion Cases 4, 6, 7, 8

<u>Conclusions</u>

These cases are all of higher order than Case #1 and therefore will have a higher I/N ratio.

>115 dB I/N Ratio

Spurious Response Check - 2nd Conversion Case #5

RF Band 400-800

First IF 172

2nd LO 242

2nd IF 70

Spurious Source 3R-2L

Spurious Frequency 554/3 = 184.66 in IF
= f_c - 12.66 MHz at RF

<u>Assumptions</u> Same as Case #1

<u>Conclusions</u>

The even order of the LO will add 25 dB to the normal conversion loss. For -120 dBm interference product level the level of the 3R term must be -95 dBm. This will occur at an input level of -25 dBm for a mixer having +30 dBm intercept point.

This is equivalent to -46 dBm at the RF amplifier input and the net I/N ratio for 3 dB loss in sensitivity is 95 dB.

95 dB I/N Ratio

In many cases the first IF BW may be less than 25 MHz. Any rejection of the spurious band by the first IF filter will result in a threefold increase in the front end I/N ratio. For instance a 4 dB rejection in the first IF would increase the front end I/N ratio to 107 dB.

APPENDIX B

POSSIBLE SOLUTION TO THE LOCAL ELECTROMAGNETIC COMPATIBILITY PROBLEMS

POSSIBLE SOLUTION TO THE LOCAL ELECTROMAGNETIC COMPATIBILITY PROBLEMS

The military community in an attempt to promote electromagnetic compatibility issues standards documents such as MIL-STD-461. These documents make no pretense that compliance will solve all compatibility problems. Rather, they are an attempt to define what can be done at reasonable cost using good engineering practice.

In a space restricted area such as the small airframe environment envisioned for MFBARS the problem can be much more severe than can be handled by mere compliance with the general standard. This problem will become more difficult as additional system concepts are introduced into the inventory, as greater portions of the frequency spectrum are utilized, and as transmit power levels are increased to increase the range/information rate capability.

Initially the MFBARS inventory may consist of separate antennas for each system with each aircraft installation having its own unique set of antenna to antenna isolation characteristics. As antenna technology advances the MFBARS inventory may converge toward the utopian condition of having all systems operating from a single antenna. This configuration presents the most severe requirements as far as self-jamming is concerned and if it can be solved then it will not be necessary to solve the problem for each aircraft installation regardless of how many antennas are used on their locations.

The solution to this problem requires the solution to two independent problems:

1) To prevent noise and spurious generated in the transmitter at or near the receiver frequency from degrading the receiver noise figure.

2) To prevent the desired transmit frequency from overloading the receiver and degrading the receiver noise figure.

Tables B-1 and B-2 define the magnitude of the problem assuming integrated antennas covering 30 to 400 MHz in one case and a phased array covering 225 to 400 and 960 to 1554 MHz. Figure B-1 shows one possible method by which the problems may be solved using an emerging technology concept called a PARATUNE. This technique, developed under AFAL contracts F33615-76-C-1222 and F33615-76-C-1318, provides a means of significantly reducing undesired noise and spurious present in the transmit spectrum. Further extension of these techniques to a notch filter having a low loss and noise figure may be a feasible technique to solve the overload problem. Figure B-2 shows two possible techniques toward development of a broadband interference cancellation technique using a sample of the transmitted signal as the reference. In the configuration show separation of the transmit and received signals is performed by a circulation and the amount of transmit signal leakage will be determined primarily by the antenna VSWR with 15 dB return loss being a typical number. Both configurations are designed to minimize the impact on receiver noise figure. To do this requires an undesirable high-power linear amplifier in one case or development of a low noise differential input RF amplifier having good common mode rejection at high signal levels for the other case.

Table B-1. VHF/UHF Problem Magnitude

Harmonic, Spurious Coupling	
Typical good specification -80 dBc	(-40 dBm for P_T = 10 watts)
Typical Receiver input noise 4 dB NF	-130 dBm
Required coupling for 0.1 dB NF degradation	-145 dBm
Required improvement	95 dB
Noise Coupling	
Typical good noise floor -160 dBc/Hz	(-120 dBm/Hz for P_T = 10 watts)
Typical receiver input noise density	-170 dBm/Hz
Required coupling for 0.1 dB degradation	-185 dBm/Hz
Required improvement	65 dB
Receiver Saturation	
Transmitter Power (10 watts)	+40 dBm
Typical Receiver input saturation level	0 dBm
Required improvement	40 dB

Table B-2. UHF/L-Band Problem Magnitude

Harmonic, Spurious Coupling (i.e. 343 MHz x 3 = 1030 MHz)	
Typical good specification -80 dBc	(-40 dBm for P_T = 10 watts)
Typical Receiver input noise 4 dB NF) 5 MHz BW	-103 dBm
Required coupling for 0.1 dB degradation	-118 dBm
Required isolation	68 dB
Noise Coupling (L Band/L Band)	
Typical good noise floor -160 dBc/Hz	(-100 dBm/Hz for P_T = 1000w)
Typical duty cycle (10%)	-10 dB
Typical Receiver noise density	-170 dBm/Hz
Require coupling for 0.1 dB degradation	-185 dBm/Hz
Required isolation	75 dB
Receiver Saturation (L Band/L Band)	
Transmitter Power (1000 watts)	+60 dBm
Typical Receiver Saturation	0 dBm
Typical Preselect rejection	20 dB
Required Isolation	40 dB

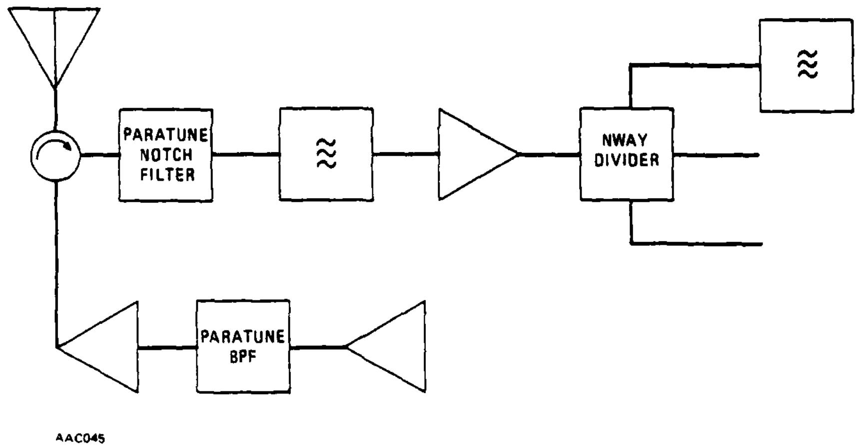


Figure B-1. Configuration to Allow Simultaneous T/R in Same Antenna/Band

The ability of the loops of Figure B-2 to cancel strong interference depends on the assumption that the signal reflected from the antennas is the same as coupled from the transmitter. This may not always be the case as non-linearity may be caused by passive components, as pointed out in Reference 1. The implication of non-linearities in the transmit path of a high-power 30 MHz signal are significant relative to their effect on harmonically related receivers. In addition, the variation in passive reflection coefficients with frequency may be a significant factor in determining bandwidth of any cancellation technique.

Perhaps one of the most important tasks facing MFBARS system designers is to establish some consistent measure for evaluating the effectiveness of various designs in providing co-site compatibility. The procedures outlined in Reference 2 appear to be a reasonable starting point for such a rating system. Modification to the suggested procedure may be

Reference 1: Fred Matos, "A Brief Summary of Intermodulation Due to Microwave Transmission Components," IEEE Transactions on Electromagnetic Compatibility, Feb 1977

Reference 2: "Final Report of Ad Hoc Committee on an Electromagnetic Compatibility Figure of Merit (EMC FOM) for Single Channel Voice Communication Equipment," IEEE Transactions on Electromagnetic Compatibility, Feb 1975

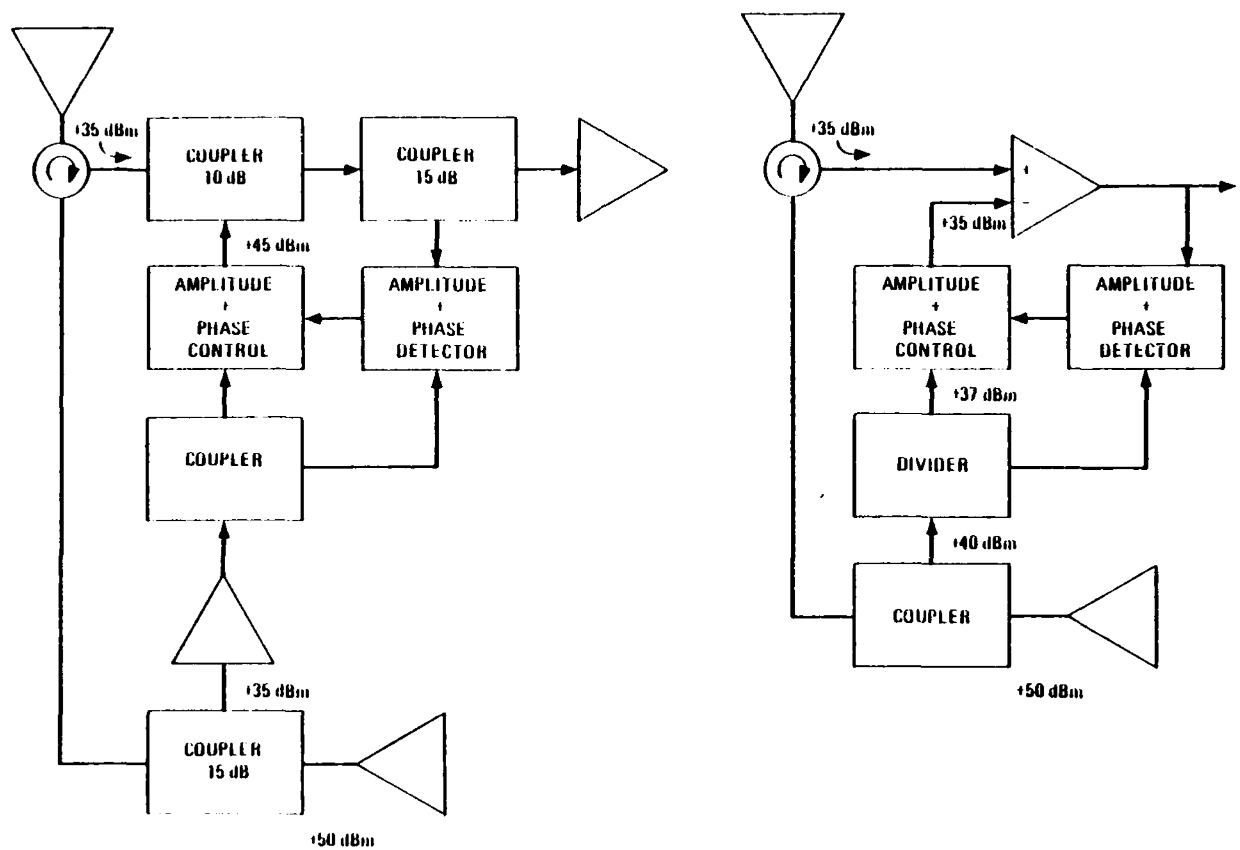


Figure B-2. Adaptive Leakage Cancellation

desirable in such areas as using software controlled test equipment to obtain and reduce more data points or to account for unique situations such as jamming by addition of other grading parameters and the modification of weighting factors. This technique will be a valuable tool in determining where to allocate technology development funds for maximum return.

APPENDIX C

SWITCHED VERSUS DEDICATED RF CONVERSION

APPENDIX C

SWITCHED VERSUS DEDICATED RF CONVERSION

A comparison has been made of a switched versus dedicated RF Conversion as shown in Figure C-1 and Table C-1 to arrive at the following conclusions.

a. The switched system projects as being 5% less expensive than the dedicated system.

b. The switched system projects as having a 10% lower failure rate.

c. A single failure in the switched system will cause loss of both receive and transmit capability 60% of the time and loss of only transmit capability 40% of the time.

d. A single failure in the dedicated system will cause loss of both capabilities 30% of the time, loss of transmit 50% of the time and loss of receive 20% of the time.

e. The switched system results in a size and weight reduction of about 5%.

These conclusions indicate that there is no gross advantage for either architecture. Further refinement of the assumed data as well as value judgments as to the importance of lower failure rate, smaller size and weight, and graceful degradation are required before a final decision can be made. It appears however that the switched system may have a slight cost advantage.

To test the validity of this conclusion a complement consisting of three receivers and one transmitter was configured as shown in Table C-2.

Comparison of these configurations arrived at the following conclusions.

a. The dedicated system projects as being 5% less expensive.

b. The dedicated system projects as being 10% more reliable and 10% smaller.

c. A single failure will cause loss of transmit capability 18% of the time for the switched case and 28% of the time for a dedicated case.

It is apparent that the baseline assumed will determine which architecture is the best. For the present it appears desirable to retain the option of using either approach by specifying the switching function as a separate module(s). The penalty paid for this is an increase in the number of interconnect coax cables in the switched configuration.

If the capability of Table C-2 is desired and it is assumed that the transmit duty cycle is low then there exists the opportunity to use a combination of the two architectures to significantly increase mission effectiveness at very little cost. When there was no transmit requirement the conversion hardware would be used to monitor activity throughout the band of interest. This data collected could be information on general

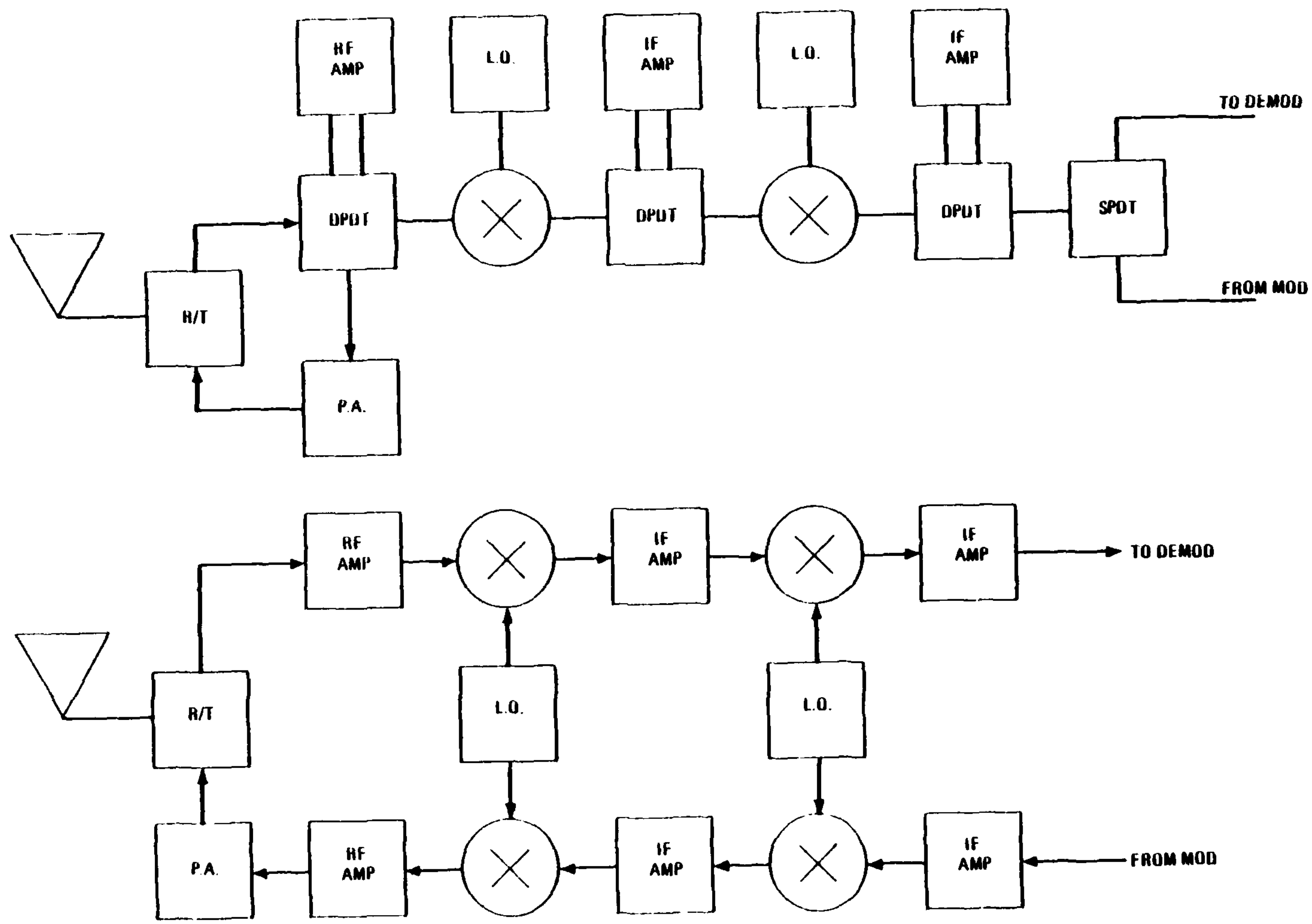


Figure C-1. Comparison of Switched Versus Dedicated RF Converter IR/IT

Table C-1. Switched vs. Dedicated, 1 Receiver, 1 Transmitter

Module	Est. Cost ($1000)	Failure Rate	Quantity		Total Cost		Total Failure Rate		Module Size Incre-ments	Total Size	
			Switched	Dedi-cated	Switched	Dedi-cated	Switched	Dedi-cated		Switched	Dedi-cated
R/T	0.25	1	1	1	0.25	0.25	1	1	1	1	1
RF Preamplifier	0.50	1.5	1	2	0.50	1.00	1.5	3.0	1	1	2
1st IF Amp	0.50	2.0	1	2	0.50	1.00	2.0	4.0	2	2	4
2nd IF Amp	0.70	2.5	1	2	0.70	1.40	2.5	5.0	2	2	4
1st L.O.	2.00	4.0	1	1	2.00	2.00	4.0	4.0	4	4	4
2nd L.O.	0.50	1.5	1	1	0.50	0.50	1.5	1.5	1	1	1
SPDT	0.20	1	1	0	0.20	0	1	0	1	1	0
DPDT	0.35	1	3	0	1.05	0	3	0	1	3	0
Power Amp	2.50	6.0	1	1	2.50	2.50	6	6	6	6	6
					8.20	8.65	22.5	24.5		21	22

Switched vs Dedicated
1 Receiver, 1 Transmitter

Table C-2. Switched vs. Dedicated, 3 Receivers, 1 Transmitter

Module	Est. Cost ($1000)	Failure Rate	Quantity		Total Cost		Total Failure Rate		Module Size Incre-ments	Total Size	
			Switched	Dedi-dated	Switched	Dedi-cated	Switched	Dedi-cated		Switched	Dedi-cated
R/T	0.25	1	1	1	.25	.25	1	1	1	1	1
RF Preamplifier	0.50	1.5	3	4	1.5	2.0	4.5	6.0	1	3	4
1st IF Amp	0.50	2.0	3	4	1.5	2.0	6.0	8.0	2	6	8
2nd IF Amp	0.70	2.5	3	4	2.1	2.8	7.5	10.0	2	6	8
1st L.O.	2.00	4.0	3	3	6.0	6.0	12.0	12.0	4	12	12
2nd L.O.	0.50	1.5	3	3	1.5	1.5	4.5	4.5	1	3	3
SPDT	0.20	1	3	0	0.6	0	3.0	0	1	3	0
DPDT	0.35	1	9	0	3.15	0	9.0	0	1	9	0
SP3T	0.35	1	1	2	.35	.70	1.0	2.0	1	1	2
Power Amp	2.50	6.0	1	1	2.50	2.50	6.0	6.0	5	6	6
					19.45	17.75	54.5	49.5		50	44

Switched vs Dedicated
3 Receivers, 1 Transmitter

band activity or if procedures were set up to include coded address and priority within the transmission the incoming signals might be handled on a "one at a time basis" with a significant reduction in on-board hardware.

APPENDIX D

SPECIFICATION SHEETS

APPENDIX D

This appendix contains copies of the specification sheets originated by engineering for identifying module design characteristics. These design characteristics were translated into PRICE inputs as shown in Section 4.

MODULE # ________ NAME JTIDS

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT			
complex		*	
DESIGN REPEATS			20 %

EXPERTISE	
NARROW	
[illegible]	
BROAD	*

BLOCK DIAGRAMS:

	CONDUCTION
	CONVECTION
X	FORCED AIR
	other

Size 2400 in^3 weight 150 lbs Power dissipation: 350 watts

WEX 35 lbs

INTERFACES	
Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	estimate	actual	
R/C	900		
SS	100		
IC SS	70		
IC MS	100		
IC LS	30		
RAM/PROM			
Hybrid	100		
other			
TOTAL	1300		

circuit type	
DIGITAL	40
ANALOG	60
RF/MICROWAVE	
TRANSMITTER	
	100 %

PRICE COSTS

DEV	30500
PROD	38062
TOTAL	68562

```
MA100 JTIDS 1 OF 3
1000 10 50 .463 1
1 .01 .01 150 150
38 5.52 0 1 2
.7 8.2 0 1
117 433
84 24 32 2.5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ________ NAME IFF INTERROGATOR

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
COMPLEX			
DESIGN REPEATS	15 %		

EXPERTIZE	
NARROW	
[illegible]	
BROAD	*

BLOCK DIAGRAMS

	Conduction
	Convection
X	FORCED AIR
	other

Size 450 in^3 weight 22 lbs Power dissipation 120 watts

WEX 14 lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	180		
SS	40		
IC SS	30		
IC MS	25		
IC LS	15		
RAM/PROM			
Hybrid			
other			
TOTAL	280		

circuit type	
DIGITAL	40
ANALOG	60
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	1250
PROD	11283
TOTAL	12533

```
MA100 IFF INT
1000 10 22 .2604 1
1 .01 .10 150 150
8 5.52 0 1 2
.7 8.098 0 1
120 280
98 12 18 .5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME IFF TRANSPONDER

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT		X	
COMPLEX			
DESIGN REPEAT	15 %		

EXPERTISE	
NARROW	
[illegible]	
BROAD	*

BLOCK DIAGRAM:

	CONDUCTION
	CONVECTION
X	FORCED AIR
	OTHER

SIZE 270 in^3 WEIGHT 12 lbs POWER DISSIPATION: 40 WATTS

WEX 5 lbs

INTERFACES

Signal Coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom
R/C	130	
SS	30	
IC SS	25	
IC MS	23	
IC LS	2	
RAM/PROM		
Hybrid		
other		
TOTAL	240	

circuit type

DIGITAL	50
ANALOG	50
RF/MICROWAVE	
TRANSMITTER	
	100 %

PRICE COSTS

DEV	601
PROD	4900
TOTAL	5501

```
MA100 IFF TRANS
1000 10 12 .1563
1 .01 .01 150 150
7 5.52 0 1 2
.7 8.102 0 1
40 240
98 12 18 .5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME TACAN

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
complex			
DESIGN REPEAT		10 %	

EXPERTISE	
NARROW	
[illegible]	
BROAD	*

BLOCK DIAGRAMS

	conduction
	convection
/	FORCED AIR
	other

Size ______ in^3 weight 11 lbs Power dissipation: 40 watts

WEX 6 lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom
R/C	130	
SS	20	
IC SS	20	
IC MS	18	
IC LS	2	
RAM/PROM		
Hybrid	10	
other		
TOTAL	200	

circuit type	
DIGITAL	60
ANALOG	40
RF/MICROWAVE	
TRANSMITTER	
	100 %

PRICE COSTS

DEV	570
PROD	5443
TOTAL	6013

```
MA100 TACAN
1000 10 11 .1215 1
1 .01 .01 150 150
.5 5.52 0 1 2
.7 8.084 0 1 2
40 200
98 12 18 .5
1.16 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME GPS

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
COMPLEX			
DESIGN REPEAT		30 %	

EXPERTISE	
NARROW	
[illegible]	
BROAD	*

FUNCTION/SPECIFICATIONS

STANDALONE EQUIP

BLOCK DIAGRAM:

- [ ] conduction
- [ ] convection
- [x] FORCED AIR
- [ ] other

Size 2000 in³ weight 60 lbs Power dissipation: 150 watts

WEX 35 lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	300		
SS	50		
IC SS	20		
IC MS	20		
IC LS	10		
RAM/PROM	10		
Hybrid	10		
other			
TOTAL	420		

circuit type

DIGITAL	50
ANALOG	50
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	17729
PROD	23316
TOTAL	41045

```
MA100 GPS
1000 10 60 .6804 1
1 .01 .01 150 150
25 5.52 0 1 2
.85 7.974 0 1
150 420
84 24 32 2.5
116 0 .8782
1978 0 1 1 1
1.8 1 1 1 1
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME ILS

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEAT		15 %	

EXPERTISE	
NARROW	
Avg	*
BROAD	

BLOCK DIAGRAM:

	conduction
	convection
X	FORCED AIR
	other

Size 180 in³ weight 5 lbs Power dissipation: 2 watts

WEX 3 lbs

INTERFACES	
Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	150		
SS	10		
IC SS	20		
IC MS	10		
IC LS			
RAM/PROM			
Hybrid	10		
other			
TOTAL	200		

circuit type	
DIGITAL	40
ANALOG	60
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	374
PROD	2767
TOTAL	3141

```
MA100 ILS VOR
1000 10 5 .1042 1
1 .01 .01 150 150
2 5.52 0 1 2
.85 8.007 0 1
8 200
98 12 18 .5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME HF R/T

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTISE	
NARROW	
MED	*
BROAD	

BLOCK DIAGRAMS

	Conduction
	Convection
X	FORCED AIR
	other

Size 400 in^3 weight 12 lbs Power dissipation: 80 watts

WEX 6 lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	220		
SS	40		
IC SS	15		
IC MS	10		
IC LS	5		
RAM/PROM			
Hybrid	10		
other			
TOTAL	300		

circuit type

DIGITAL	30
ANALOG	70
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	671
PROD	5541
TOTAL	6212

```
MA100 HF RT
1000 10 12 .2315 1
1 .01 .01 150 150
6 5.52 0 1 2
.7 8.094 0 1
80 300
98 12 18 .5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME VHF-FM R/T

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

2 RECEIVE
1 TRANSMIT

BLOCK DIAGRAM:

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		15 %	

EXPERTISE	
NARROW	
Med	*
BROAD	

	conduction
	convection
X	FORCED AIR
	other

Size 180 in^3 weight 5 lbs Power dissipation: 10 watts

WEX 3 lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	140		
SS	25		
IC SS	25		
IC MS	23		
IC LS	2		
RAM/PROM			
Hybrid	5		
other			
TOTAL	220		

circuit type

DIGITAL	25
ANALOG	75
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	394
PROD	3034
TOTAL	3428

```
MA100 UHFFM RT
1000 10 5 .1042 1
1 .01 .01 150 150
2 5.52 0 1 2
.7 8.116 0 1
10 220
96 12 18 .5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME VHF-AM R/T

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

4 Receivers
1 Transmitter

BLOCK DIAGRAM:

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		15 %	

EXPERTISE	
NARROW	
[illegible]	*
BROAD	

	Conduction
	Convection
X	FORCED AIR
	other

Size 270 in^3 weight 7 lbs Power dissipation: 18 watts
WEX 4 lbs

INTERFACES

Signal Coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	150		
SS	30		
IC SS	35		
IC MS	30		
IC LS	5		
RAM/PROM			
Hybrid	10		
other			
TOTAL	260		

circuit types

DIGITAL	25
ANALOG	75
RF/MICROWAVE	
TRANSMITTER	
	100 %

PRICE COSTS

DEV	492
PROD	3904
TOTAL	4396

```
MA100 VHFAM RT
1000 10 7 .1563 1
1 .01 .01 150 150
3 5.52 0 1 2
.7 S.115 0 1
1S 260
9S 12 1S .5
116 0 .S782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ________ NAME UHF R/T

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS			10 %

EXPERTISE	
NARROW	
MED	*
BROAD	

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

3 SIMULTANEOUS Receivers
1 Transmitter

BLOCK DIAGRAM:

	Conduction
	convection
X	FORCED AIR
	other

Size 240 in³ weight 6 lbs Power dissipation: 18 watts

WEX 3 lbs

INTERFACES

Signal Coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	140		
SS	30		
IC SS	35		
IC MS	30		
IC LS	5		
RAM/PROM			
Hybrid	10		
other			
TOTAL	250		

circuit type

DIGITAL	30
ANALOG	70
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	404
PROD	3118
TOTAL	3521

```
MA100 UHFAM RT
1000 10 6 .1388 1
1 .01 .01 150 150
3 5.52 0 1 2
.9 8.125 0 1
18 250
98 12 18 .5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME SEEKTALK

FUNCTION/SPECIFICATIONS

5 ELEMENT ADAPTIVE ARRAY, SPREAD SPECTRUM Signal - DAIS INTERFACE

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT			
COMPLEX		*	
DESIGN REPEAT		20 %	

EXPERTISE	
NARROW	
[illegible]	
BROAD	*

BLOCK DIAGRAM:

	conduction
	convection
X	FORCED AIR
	other

Size 620 in³ weight 27 lbs Power dissipation: 30 watts

WEX 15 lbs

INTERFACES

Signal COAX	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	300		
SS	50		
IC SS	20		
IC MS	50		
IC LS	20		
RAM/PROM			
Hybrid	60		
other			
TOTAL	500		

circuit type

DIGITAL	40
ANALOG	60
RF/MICROWAVE	
TRANSMITTER	
	100 %

DEV	10571
PROD	12917
TOTAL	23487

```
MA100 SEEKTALK
1000 10 27 .5208 1
1 .01 .01 150 150
12 5.52 0 1 2
.7 8.136 0 1
30 500
64 24 32 2.5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE #________ NAME IFE CRYPTO

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT		X	
COMPLEX			
DESIGN REPEATS		20 %	

EXPERTISE	
NARROW	
[illegible]	X
BROAD	

BLOCK DIAGRAM:

	CONDUCTION
	CONVECTION
	FORCED AIR
	OTHER

Size 32 in^3 weight 3 lbs Power dissipation: 2 watts
WEX 1 lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	40		
SS	10		
IC SS		2	
IC MS		3	
IC LS		5	
RAM/PROM	2		
Hybrid	3		
other			
TOTAL	55	10	65

circuit type

DIGITAL	95
ANALOG	5
RF/MICROWAVE	
TRANSMITTER	
	100 %

PRICE TOTAL

DEV	239
PROD	1723
TOTAL	1962

```
MA100 IFF CRYP
1000 10 3 .0833 1
1 .01 .01 150 150
1.5 5.52 0 1 2
.9 8.117 0 1
2 65
98 12 18 .5
116 0 .8792
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME COM crypto

FUNCTION/SPECIFICATIONS

STANDALONE EQUIPMENT

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
Difficult		*	
complex			
DESIGN REPEAT		20 %	

EXPERTISE	
NARROW	
[illegible]	*
BROAD	

BLOCK DIAGRAMS

	CONDUCTION
	CONVECTION
	FORCED AIR
	other

Size 80 in^3 weight 5 lbs Power dissipation 3 watts

WEX 2 lbs

INTERFACES

Signal Coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	60		
SS	20		
IC SS		5	
IC MS		10	
IC LS		15	
RAM/PROM	2		
Hybrid	2		
other			
TOTAL	84	30	114

circuit type

DIGITAL	95
ANALOG	5
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	296
PROD	2132
TOTAL	2429

```
MA100 COM CRYP
1000 10 5 .0463 1
1 .01 .01 150 150
3 5.52 0 1 2
.9 8.032 0 1
3 114
98 12 18 .5
116 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # ______ NAME ~~[illegible]~~ JTIDS/IFF/TACAN

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
COMPLEX			
DESIGN REPEATS		27 %	

EXPERTIZE	
NARROW	
MED	
BROAD	X

FUNCTION/SPECIFICATIONS

STANDALONE EQUIP -

BLOCK DIAGRAM:

	Conduction
	Convection
X	FORCED AIR
	other

Size 3300 in^3 weight 160 lbs Power dissipation: 450 watts

WEX 40 lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	1150		
SS	140		
IC SS	110		
IC MS	125		
IC LS	32		
RAM/PROM			
Hybrid	110		
other			
TOTAL	1667		

circuit type

DIGITAL	50
ANALOG	10
RF/MICROWAVE	20
Transmitter	20
	100 %

PRICE COSTS

DEV	32628
PROD	41577
TOTAL	74205

```
DEDICATED JTIDS IFF TACAN
1000 10 60 .716 1
1 .01 .01 150 150
45 5.52 0 1 2
.7 6.209 0 1 0
169 625
84 24 32 2.5
116 0 .8782
1978 0 1 1 1
1.8 1 1 1 1
```

1 of 1

```
DEDICATED JTIDS IFF TACAN
1000 10 50 .597 1
1 .01 .01 150 150
37.5 5.52 0 1 2
.7 6.209 0 1 0
141 520
84 24 32 2.5
116 0 .8782
```

1 of 2

ARCHITECTURES 1 2 3 4 5

MODULE # ______ NAME RF ENCLOSURE 1

FUNCTION/SPECIFICATIONS

This module provides a full ATR size mounting base and interconnect for the groups of modules

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT			
complex			
DESIGN REPEATS			70

EXPERTIZE	
NARROW	
MED	
BROAD	

BLOCK DIAGRAM:

- [ ] Conduction
- [ ] Convection
- [ ] FORCED AIR
- [ ] other

Size 2900 in³ weight 7 lbs Power dissipation: ______ watts

WEX 0

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C			
SS			
IC SS			
IC MS			
IC LS			
RAM/PROM			
Hybrid			
other			
Total			

circuit type

DIGITAL	
ANALOG	
RF/MICROWAVE	
Transmitter	
	100%

PRICE COSTS

DEV	130
PROD	1697
TOTAL	1831
EACH TOTAL	366

```
MA300 ENCLOSURE 1
5000 50 7 1.71 2
5 0 0 150 150
7 5.52 0 1 2
109 6 12 .5 0
121 0 .8560
1978 0 1 1 1
1.8 1 1 1 1
```

architectures 1 2 3 4 5 6 7 8 9 10

MODULE # ________ NAME RF ENCLOSURE 2

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT			
complex			
DESIGN REPEATS			%

FUNCTION/SPECIFICATIONS

This module provides a 1/2 ATR size mounting base and interconnect for the groups of modules

EXPERTIZE

NARROW	
MED	
BROAD	

BLOCK DIAGRAM:

- [ ] Conduction
- [ ] Convection
- [ ] FORCED AIR
- [ ] other

Size ______ in^3 weight 5 lbs Power dissipation ______ watts

WEX 0

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C			
SS			
IC SS			
IC MS			
IC LS			
RAM/PROM			
Hybrid			
other			
Total			

circuit type

DIGITAL	
ANALOG	
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	90
PROD	1293
Total	1383
Total Each	277

MA300 ENCLOSURE 2
5000 50 5 .833 2
5 0 0 150 150
5 5.52 0 .3 2
109 6 12 .5 0
.21 0 .6541

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # 1 NAME Dual GPS PREAMP

FUNCTION/SPECIFICATIONS

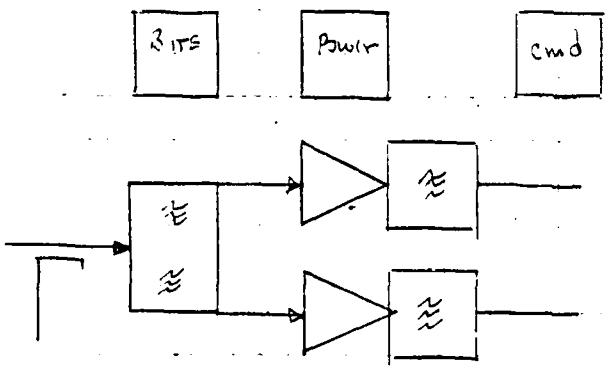
Provides HI/LO FREQUENCY splitting, Low Noise AMPLIFICATION, AND NARROW Band filtering, couples in BITE signal, Provides power buss coupling, EMI shielding

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS		50 %	

EXPERTISE	
NARROW	X
MED	
BROAD	

BLOCK DIAGRAMS



	Conduction
X	Convection
	FORCED AIR
	other

Size 32 in^3 weight 1 lbs Power dissipation: 1 watts

weight Ex 0.4

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
Control	3 bits

Components	catalog	custom	
R/C	45		
SS	4		
IC SS	2		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid			
other	7		
TOTAL	60	0	60

circuit type

DIGITAL	10
ANALOG	20
RF/Microwave	70
Transmitter	
	100 %

PRICE Costs:

DEV.	175
PROD.	1785
TOTAL	1960
EACH TOTAL	492

```
MA300 FF MOD1 DUAL GPS PREAMF
5000 50 1 .017 1
5 .8 .4 150 150
.6 5.52 0 1 2
.85 8.089 0 1 .4
1 60 0 0 0
102 13 19 1
121 0 .854 0 0
1978 0 1 1 1
1.8 1 1 1 1
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9

Rev 12/5/78

MODULE # 2 NAME GPS WEIGHTING

FUNCTION/SPECIFICATIONS

PROVIDES ELEMENT WEIGHTING AND SUMMATION FOR ADAPTIVE ANTENNA

COMPLEXITY

	MOD	NEW	JOA
SIMPLE			
ROUTINE			X
DIFFICULT			
COMPLEX			
DESIGN REPEATS		70	7o

EXPERTISE	
NARROW	
MED	
BROAD	*

BLOCK DIAGRAM:

See attached

	Conduction
	Convection
	FORCED AIR
	other

Size ~~90~~ 210 in^3 weight ~~8~~ 7 lbs Power dissipation: ~~5~~ 10 watts

WEX 6 lbs

INTERFACES

Signal coax	13
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
control	3 bits

Components	catalog	custom	
R/C	80		
SS	8		
IC SS	20		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid	40		
other			
TOTAL	150	0	150

circuit type

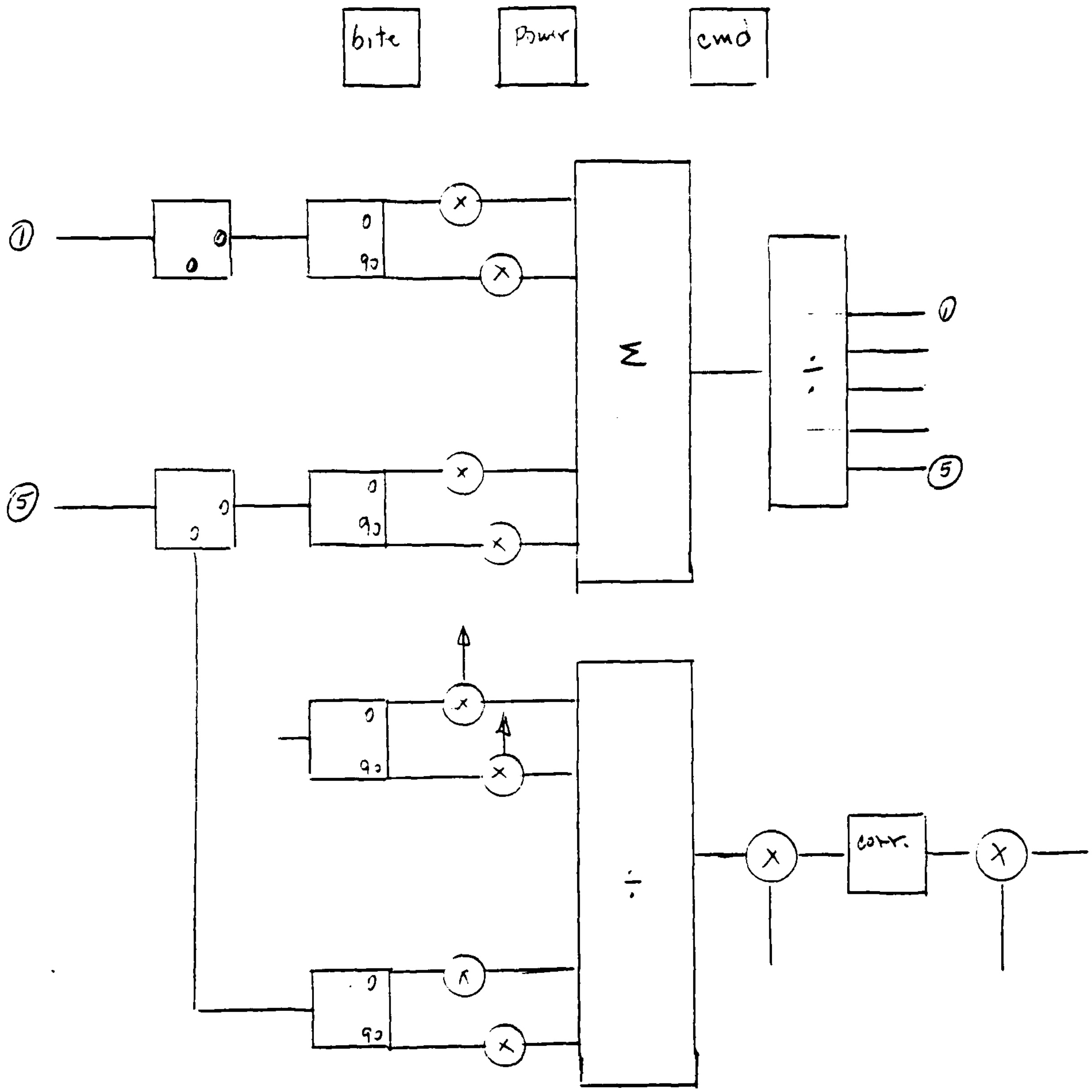
DIGITAL	10
ANALOG	10
RF/MICROWAVE	80
Transmitter	
	100 %

PRICE COSTS:

DEVELOPMENT	1504
PRODUCTION	8900
TOTAL	10404
EACH TOTAL	5202

```
MA300 RF MOD2 ELE WTG CORR
2000 20 8 .156 1
2 .8 .4 150 150
2 5.52 0 1 2
.85 8.021 0 1 .7
10 150
85 28 36 2.2 0
121 0 .8782
1978 0 1 1 1
1.8 1 1 1 1
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9



MODULE #2 GPS WEIGHTING

MODULE # 3 NAME GPS PN MODULATOR

FUNCTION/SPECIFICATIONS

Adds P or P and CA codes to Low and High frequency L.O. Signals selects HI/LO front end as required code controlled by command buss. Provides bite subsystem, Power buss subsystem interfaces.

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			X
DIFFICULT			
complex			
DESIGN REPEATS			20 %

EXPERTIZE	
NARROW	
MED	*
BROAD	

BLOCK DIAGRAM:

see attached

	Conduction
	Convection
	FORCED AIR
	other

Size 30 in^3 weight 1.25 lbs Power dissipation: 3 watts

WEX 0.5

INTERFACES

Signal coax	8
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	45		
SS	2		
IC SS	2		
IC MS	2		
IC LS	2		
RAM/PROM			
Hybrid	7		
other			
TOTAL	60	0	60

circuit type

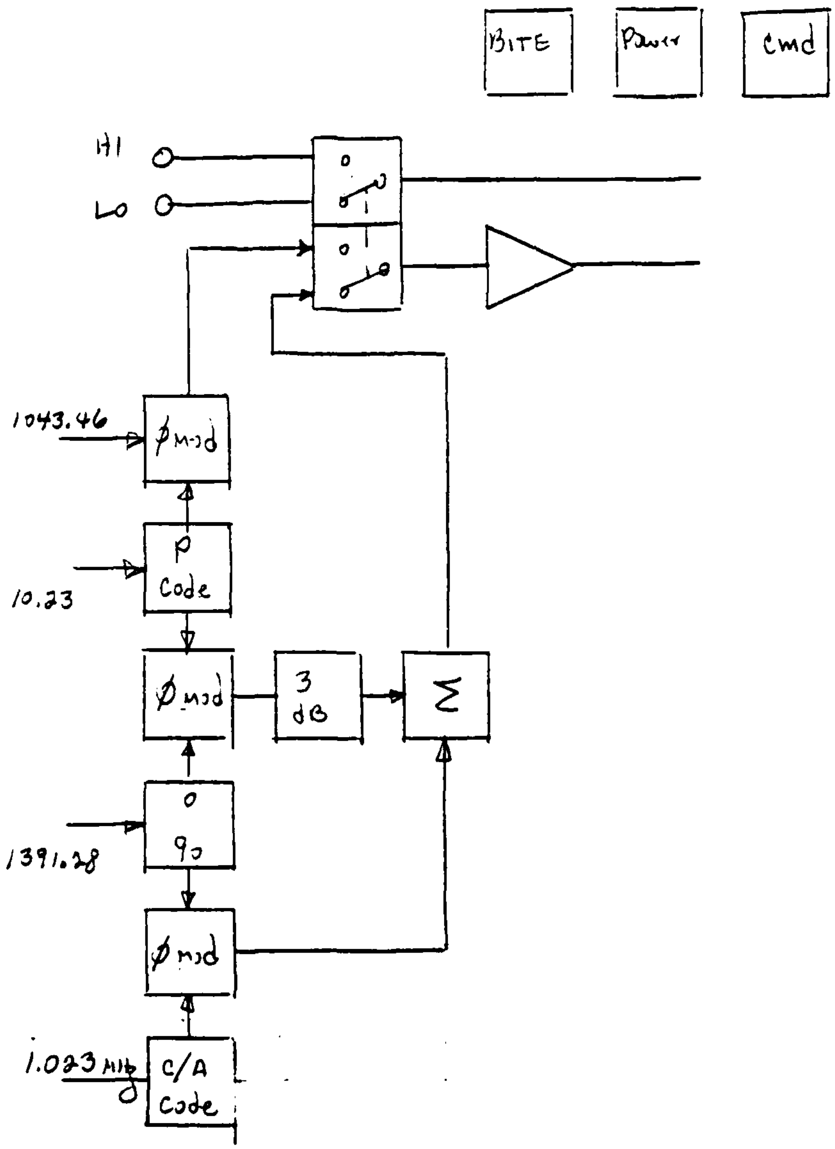
DIGITAL	30
ANALOG	10
RF/MICROWAVE	60
Transmitter	
	100 %

PRICE COSTS

DEVEL.	740
PROD.	2577
TOTAL	3318
EACH TOTAL	663

```
MA300 RF MOD3 GPS PN CORR
5000 50 1.25 .017 1
5 .8 .4 150 150
.625 5.52 0 1 2
.85 8.116 0 1 .2
3 60 0 0 0
84 29 37 2.2 0
121 0 .854 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7



MODULE #3 GPS PN MODULATOR

MODULE # 4 NAME VAR FREQ IF

COMPLEXITY

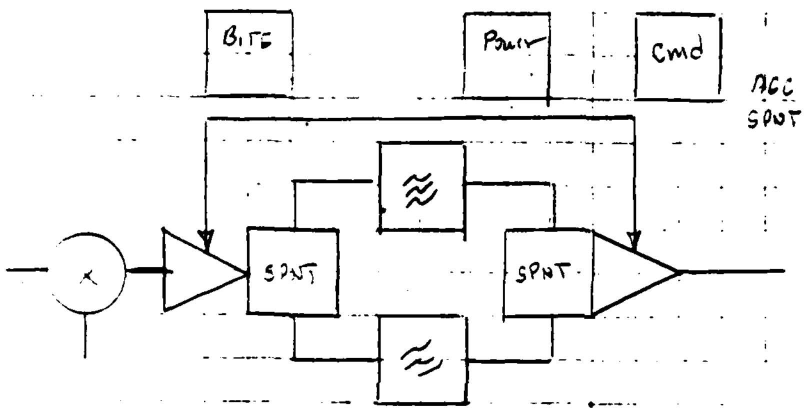
	MOD	NEW	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides down conversion, AMPLIFICATION AND FILTERING. IF center frequency and BW is user defined by inserting desired filter elements in switched filter bank. Provides 30 to 40 dB linear gain with AGC capability. Provides interface with BITE; Power Buss subsystems

BLOCK DIAGRAM:



Conduction
convection
FORCED AIR
other

Size 30 in^3 weight 1.5 lbs Power dissipation: 3 watts

WEx 0.9

INTERFACES

Signal coax	3
" analog	
Power Buss	3
Prime Power	
BITE	
Frequency Ref	
control	12 bits

Components	catalog	custom	
R/C	75		
SS	12		
IC SS	3		
IC MS	3		
IC LS	1		
RAM/PROM			
Hybrid	6		
other			
TOTAL	100	0	100

circuit type

DIGITAL	30
ANALOG	70
RF/MICROWAVE	
Transmitter	
	100 %

PRICE COSTS:

DEV	7 1 9
PROD	8 1 6 3
TOTAL	8 8 8 1
EACH TOTAL	5 2 2

```
MA300 FF MOD4 VAR FREQ IF
17000 170 1.5 .0174 1
17 .8 .4 150 150
.6 5.52 0 1 2
.85 8.115 0 1 .2
3 100 0 0 0
102 13 19 1 0
121 0 .834 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 5 NAME 70 MHz IF

COMPLEXITY

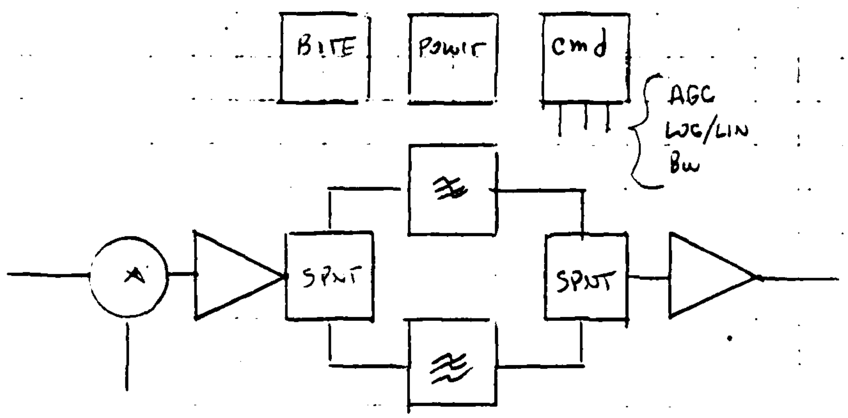
	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides down conversion, log/linear amplification and filtering via a bank of switched 70 MHz filters having user selected BW. Includes AGC capability and the majority of receiver gain (≈ 80 dB). Provides interface with BITE/Power subsystems AND good EMI protection to prevent crosstalk between IF's

BLOCK DIAGRAM:



	Conduction
	Convection
	FORCED AIR
	other

Size 30 in^3 weight 15 lbs Power dissipation: 4 watts

WEX 0.9

INTERFACES

Signal coax	3
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
Control	12 bits

Components	catalog	custom	
R/C	75		
SS	10		
IC SS	6		
IC MS	2		
IC LS	1		
RAM/PROM			
Hybrid	6		
other			
TOTAL	100	0	100

circuit type

DIGITAL	15
ANALOG	85
RF/MICROWAVE	
Transmitter	
	100 %

PRICE COSTS

DEV	695
PROD.	7733
TOTAL	8428
EACH TOTAL	500

```
MA300 RF MOD5 70 MHZ IF
17000 170 1.5 .0174 1
17 .8 .4 150 150
.6 5.52 0 1 2
.85 8.05 0 1 .2
4 100 0 0 0
102 13 19 1
121 0 .834 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 6 NAME GPS L.O. SYNTHESIZER

COMPLEXITY

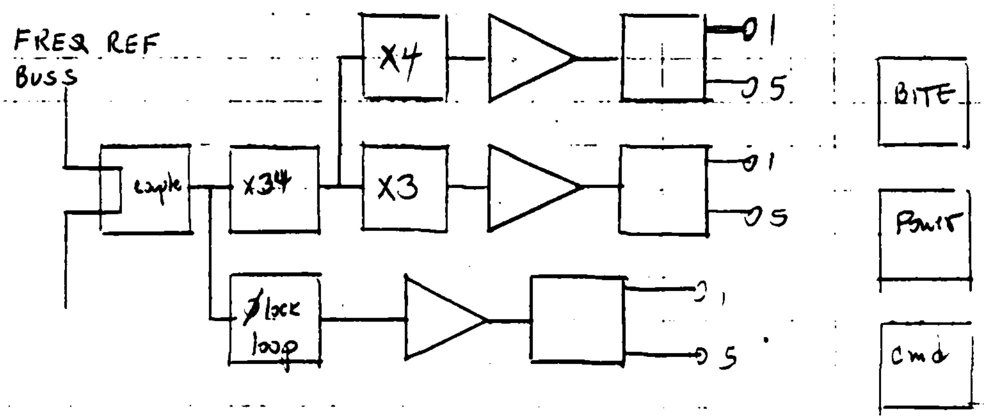
	MOD	New	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS	25 %		

EXPERTISE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides L.O. frequencies to drive CA/P coders as well as 2nd L.O. frequency

BLOCK DIAGRAM:



- [ ] Conduction
- [ ] Convection
- [ ] FORCED AIR
- [ ] other

Size 30 in³ weight 1.5 lbs Power dissipation 6 watts

WEX 0.9

INTERFACES

Signal coax	16
" analog	
Power Buss	3
Prime Power	
BITE	
Frequency Ref	1
Control	3 bits

Components	catalog	custom	
R/C	110		
SS	20		
IC SS	6		
IC MS	4		
IC LS			
RAM/PROM			
Hybrid	10		
other			
TOTAL	150		150

circuit type

DIGITAL	25
ANALOG	50
RF/MICROWAVE	25
Transmitter	
	100 %

PRICE COSTS

DEV	123
PROD	596
TOTAL	719
EACH TOTAL	719

```
MA300 RF MOD6 GPS LO SYNTH
1000 10 1 .0174 1
1 .6 .4 150 150
.6 5.52 0 1 2
.65 6.096 0 1 .25
6 150
102 13 19 1
131 0 .6782
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 7 NAME Dual L Band wide Preamp

COMPLEXITY

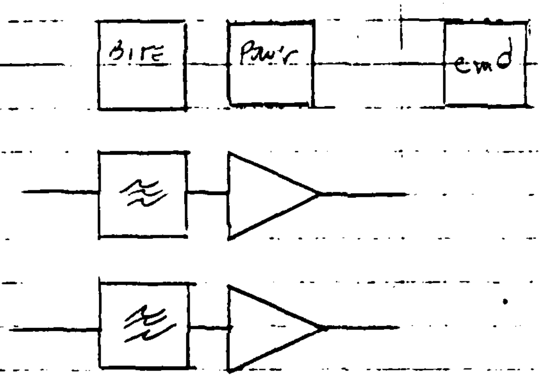
	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		50 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides filtering/preamplification over 960-1215 MHz Band-wide dynamic range. Interface with BITE + Power subsystems. MINIMUM gain to establish system noise figure.

BLOCK DIAGRAM:



- [ ] Conduction
- [ ] convection
- [ ] FORCED AIR
- [ ] other

Size 30 in^3 weight 1 lbs Power dissipation: 4 watts

WEX 0.4

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
Control	3 bits

Components	catalog	custom	
R/C	50		
SS	8		
IC SS			
IC MS	2		
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL	60		60

circuit type

DIGITAL	15
ANALOG	15
RF/MICROWAVE	70
Transmitter	
	100 %

PRICE COSTS

DEV	128
PROD.	1193
TOTAL	1321
EACH TOTAL	440

```
MA300 RF MOD7 L DUAL FT PREAMP
3000 30 1 .017 1
3 .6 .4 150 150
.6 5.52 0 1 2
.85 6.05 0 1 .5
4 60 0 0 0
102 13 19 1 0
121 0 .858 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 8 NAME Dual tunable L Band Preamp

FUNCTION/SPECIFICATIONS

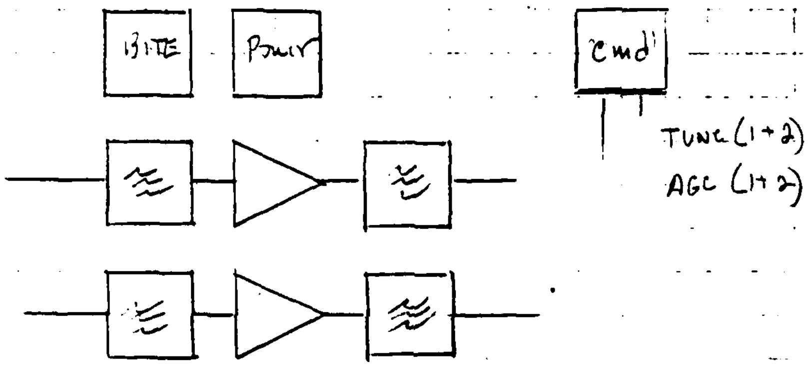
Provides narrowband tunable filtering and amplification over 960-1215 MHz range - MINIMUM gain with AGC capability, Provides BITE, Power Buss interface

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		40 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	Convection
	FORCED AIR
	other

Size 30 in³ weight 1 lbs Power dissipation: 4 watts

WEX 0.5

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
Control	31 bits

Components	catalog	custom	
R/C	80		
SS	16		
IC SS	4		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL	102	0	102

circuit type

DIGITAL	10
ANALOG	10
RF/MICROWAVE	80
Transmitter	
	100 %

PRICE COSTS

DEV	174
PROD	1675
TOTAL	1848
EACH TOTAL	462

```
MA300 RF MOD8 L DUALT PREAMP
4000 40 1 .017 1
4 .8 .4 150 150
.5 5.52 0 1 2
.85 8.021 0 1 .4
4 102 0 0 0
102 13 19 1 0
121 0 .856 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7

Rev 1/15/77

MODULE # 9 NAME L Band ELEMENT WEIGHTING

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT			X
complex			
DESIGN REPEATS		60 %	

EXPERTIZE	
NARROW	
MED	
BROAD	X

FUNCTION/SPECIFICATIONS

Accepts inputs from 5 element array, generates I/Q weights to null 4 Jamming signals, provides amplified nulled output to drive 8 parallel receiver channels

BLOCK DIAGRAM:

See attached

12 lbs

SIZE 360 in³ (5x6x12) weight 8 lbs (w ex 8 lbs) Power dissipation: 15 watts

- [ ] Conduction
- [ ] Convection
- [X] FORCED AIR
- [ ] other

INTERFACES

Signal coax	6
" analog	9
Power Buss	2
Prime Power	0
BITE	1
Frequency Ref Control	2

Components	catalog	custom	
R/C	95		
SS	5		
IC SS	10		
IC MS			
IC LS			
RAM/PROM			
Hybrid	47		
other	11		
TOTAL	168		

Circuit type

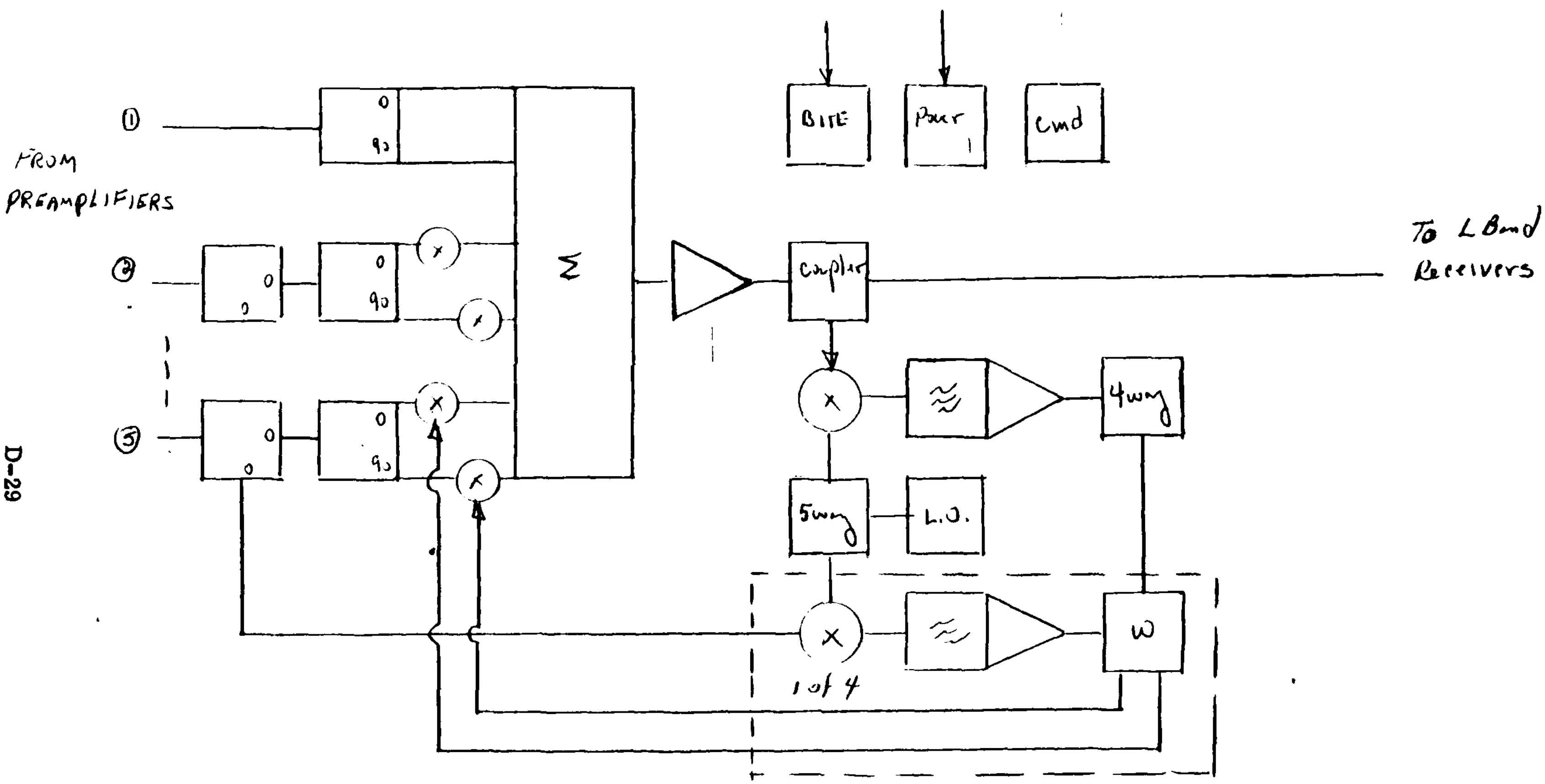
DIGITAL	5
ANALOG	10
RF/MICROWAVE	85
Transmitter	
	100 %

PRICE COSTS

DEV	1461
PROD	4034
TOTAL	5496
EACH TOTAL	5496

```
MA300 RF MODS L ELE WTG
1000 10 1389 1
1 .8 .4 150 150
.76 5.52 0 1 2
.85 7.44 0 1 .6
15 168
87 26 34 3.2
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7



L Band element weighting

MODULE #9

MODULE # 10 NAME FAST HOP SYNTHESIZER

FUNCTION/SPECIFICATIONS

PROVIDES FAST HOPPING L.O. FOR JTIDS APPLICATIONS

COMPLEXITY	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
complex			
DESIGN REPEATS			%

EXPERTIZE	
NARROW	
MED	*
BROAD	

BLOCK DIAGRAM:

	Conduction
	convection
X	FORCED AIR
	other

Size 60 in^3 weight 2 lbs Power dissipation: 17 watts

WEX 1.0

INTERFACES

Signal coax	2
" analog	
Power Buss	3
Prime Power	
BITE	
Frequency Ref	1
Control	

Components	catalog	custom	
R/C	210		
SS	40		
IC SS	20		
IC MS	5		
IC LS			
RAM/PROM	2		
Hybrid	3		
other			
TOTAL	280		280

circuit type

DIGITAL	20
ANALOG	10
RF/Microwave	70
Transmitter	
	100 %

PRICE COSTS

DEV	452
PROD	1398
TOTAL	2350
EACH TOTAL	1175

```
MA300 RF MOD10 FHOP SYNTH
2000 20 2 .035 1
2 .8 .4 150 150
1 5.52 0 1 2
.85 8.074 0 1 .2
10 280 0 0 0
96 19 25 1.5 0
121 0 .862 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 11 NAME SLOW HOP SYNTHESIZER

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides stable multioctave signal source with switching speeds compatible with scanning receivers covers frequency from 125 MHz to 2000 MHz

BLOCK DIAGRAM:

See attached

	Conduction
	Convection
X	FORCED AIR
	other

Size 60 in³ weight 2 lbs Power dissipation: 4 watts

WEX 1.0

INTERFACES

Signal coax	1
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	1
Control	21 bits

Components	catalog	custom	
R/C	80		
SS	20		
IC SS	8		
IC MS	6		
IC LS			
RAM/PROM			
Hybrid	6		
other			
TOTAL	120	0	120

circuit type

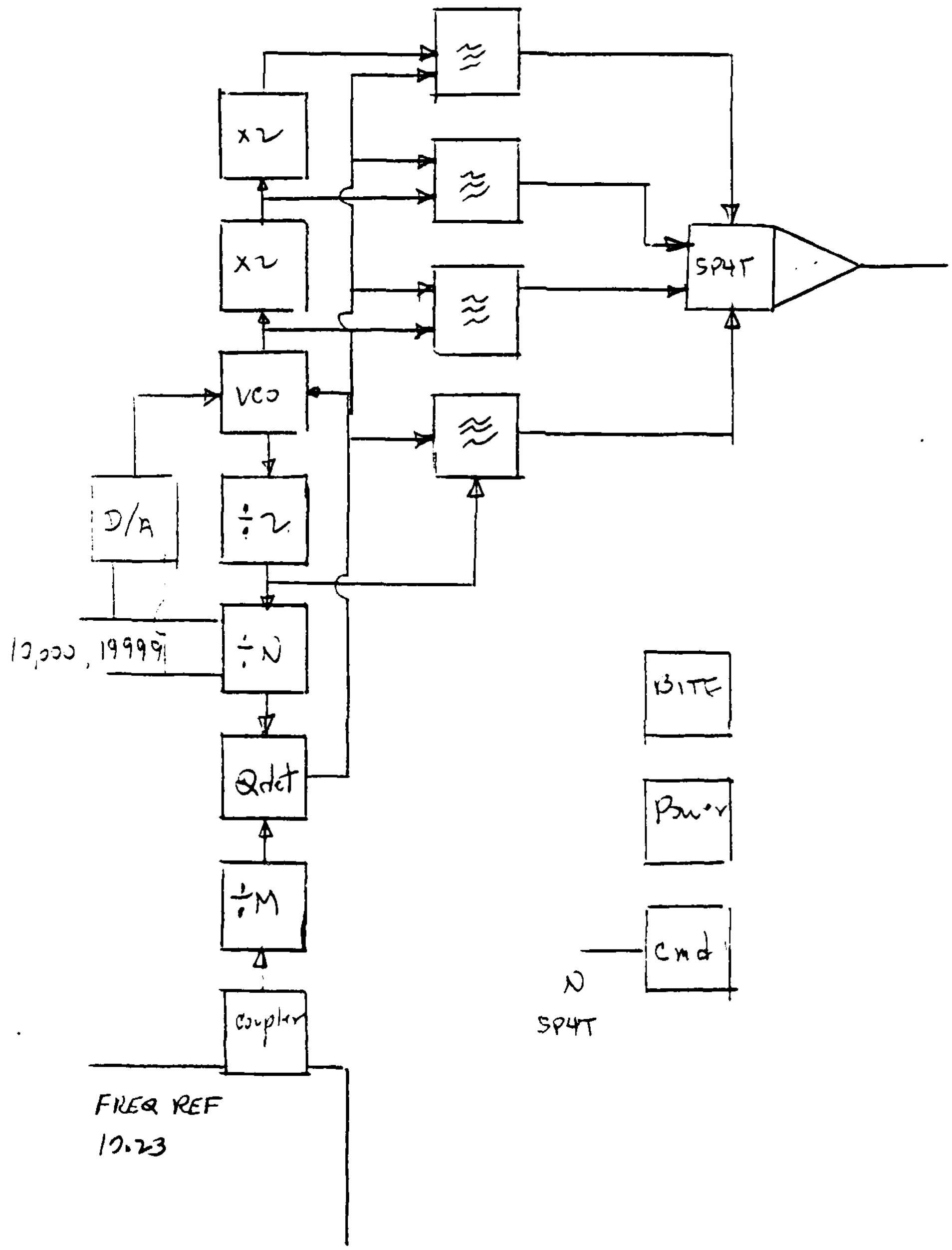
DIGITAL	40
ANALOG	30
RF/MICROWAVE	20
Transmitter	
	100 %

PRICE COSTS

DEV	608
PROD	7043
TOTAL	7651
EACH TOTAL	765

```
MA300 RF MOD11 SHOP SYNTH
10000 100 2 .035 1
10 .8 .4 150 150
1 5.52 0 1 3
.85 8.249 0 1 .2
4 120 0 0 0
102 13 19 1 0
121 0 .848 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7



SLOW HOP SYNTHESIZER

Module #11

MODULE # 12 NAME antenna Select

FUNCTION/SPECIFICATIONS

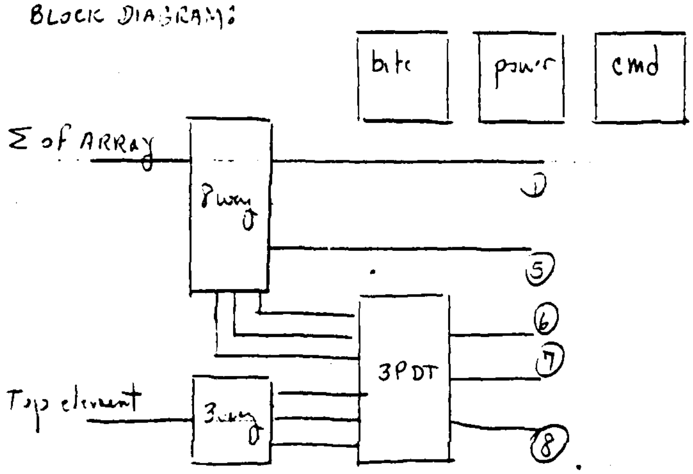
Provides IFF/TACAN/JTIDS capability from Top antenna. Provides BITE, Power interface

COMPLEXITY

	MOD	New	SOA
SIMPLE		*	
ROUTINE		-	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTIZE	
NARROW	*
Yes	
BROAD	

BLOCK DIAGRAM:



	Convection
	Conduction
	FORCED AIR
	other

Size 30 in³ weight 1 lbs Power dissipation: 2 watts

WEX 0.3

INTERFACES

Signal coax	10
" analog	
Power Buss	
Prime Power	1
BITE	
Frequency Ref	
Control	4 bits

Components	catalog	custom	
R/C	30		
SS	14		
IC SS			
IC MS	4		
IC LS			
RAM/PROM			
Hybrid	2		
other			
Total	50	0	50

circuit type

DIGITAL	30
ANALOG	20
RF/MICROWAVE	50
Transmitter	
	100 %

PRICE COSTS

DEV	100
PROD	492
TOTAL	592
EACH TOTAL	592

```
MA300 PF MOD12 ANT SEL
1000 10 1 .0174 1
1 .8 .4 150 150
.7 5.52 0 1 2
.85 6.115 0 1 .2
2 50
103 12 16 .9
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 14 NAME L Band Tx

FUNCTION/SPECIFICATIONS

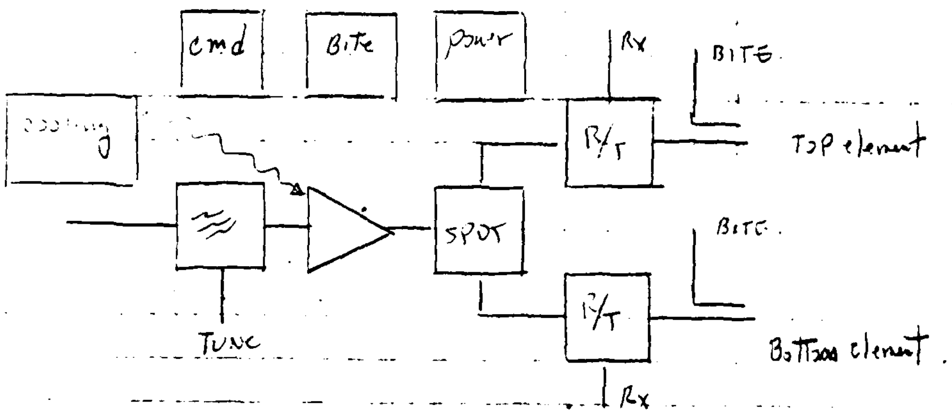
Provides JTIDS/IFF/TACAN RF power and shape with routing to proper antenna and R/T functions

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
complex			
DESIGN REPEATS		10 %	

EXPERTISE	
NARROW	
AVG	*
BROAD	

BLOCK DIAGRAM:



	Conduction
	convection
X	FORCED AIR
	other

Size 240 in^3 weight ~~[illegible]~~ 9 lbs Power dissipation: ~~[illegible]~~ 90 watts

WEX 2

INTERFACES

Signal coax	5
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	15 bits

Components	catalog	custom	
R/C	195		
SS	30		
IC SS	15		
IC MS	5		
IC LS			
RAM/PROM			
Hybrid	5		
other			
TOTAL	250	0	250

circuit type

DIGITAL	5
ANALOG	10
RF/MICROWAVE	
Transmitter	85
	100 %

PRICE COSTS

DEV.	8 6 5
PROD	2 7 [illegible] 9
TOTAL	3 5 8 4
EACH TOTAL	3 5 8 4

```
MA300 RF MOD14 L TRAN
1000 10 9 .087 1
1 .6 .4 150 150
7 5.52 0 1 2
.6 8.176 0 1 .1
90 250
95 20 26 1.5
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 15 NAME Dual Tunable UHF PREAMP

FUNCTION/SPECIFICATIONS

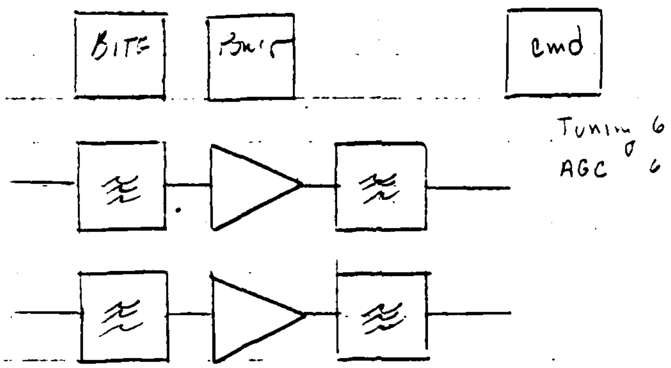
Provides tunable narrowband filtering/amplification over the 225 to 400 MHz band. Includes AGC capability and interface with BITE, Power Buss

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
COMPLEX			
DESIGN REPEATS		50 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	convection
	FORCED AIR
	other

Size 30 in³ weight 1.25 lbs Power dissipation: 3 watts

WEX 0.5

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	27 bits

Components	catalog	custom	
R/C	90		
SS	20		
IC SS	3		
IC MS	3		
IC LS			
RAM/PROM	2		
Hybrid	2		
other			
TOTAL	120	0	120

circuit type

DIGITAL	20
ANALOG	10
RF/MICROWAVE	70
Transmitter	
	100 %

PRICE COSTS

DEV	220
PROD	2470
TOTAL	2690
EACH TOTAL	540

```
MA300 RF MOD15 UHF DUALT PREAMP
5000 50 1.25 .017 1
5 .8 .8 150 150
.625 5.52 0 1 2
.65 8.074 0 1 .5
3 120 0 0 0
102 13 19 1 0
121 0 .854 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7

REV 10/5/77

MODULE # 16 NAME UHF WEIGHTING

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			*
DIFFICULT			
complex			
DESIGN REPEATS		70	70

EXPERTISE	
NARROW	
MED	
BROAD	X

FUNCTION/SPECIFICATIONS

PROVIDES ELEMENT WEIGHTING AND SUMMATION FOR Phased array

BLOCK DIAGRAM:

See attached

	Conduction
	Convection
X	FORCED AIR
	other

Size ~~96~~ ≈10 in³ weight ~~3~~ 8 lbs Power dissipation: ~~4~~ 10 watts

WEX 6 lbs

INTERFACES

Signal coax	9
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	3 bits

Components	catalog	custom	
R/C	80		
SS	8		
IC SS	20		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid	40		
other			
TOTAL	150	0	150

circuit type

DIGITAL	10
ANALOG	20
RF/MICROWAVE	70
Transmitter	
	100 %

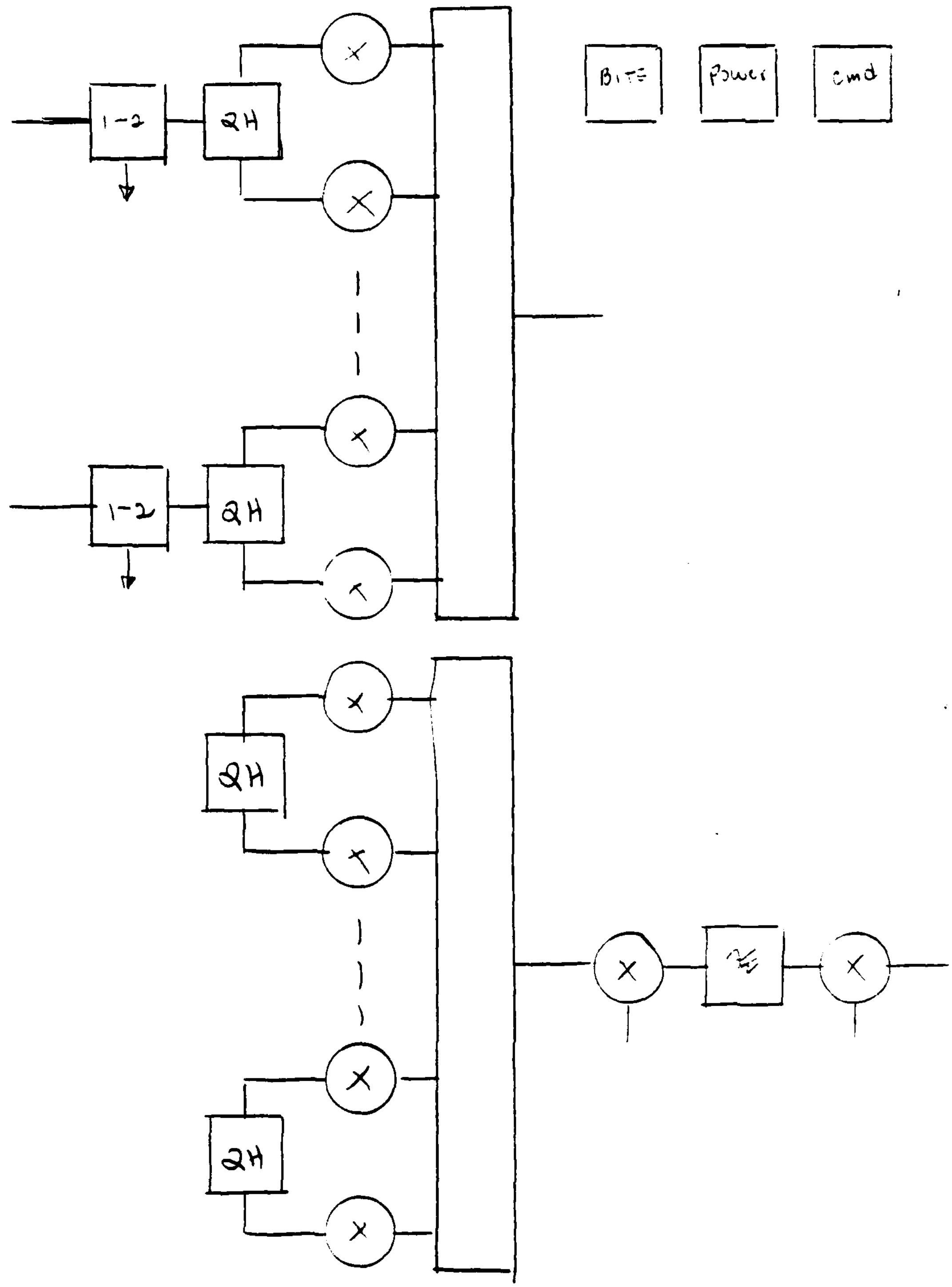
PRICE COSTS

DEV	1233
PROD	5066
TOTAL	6299
EACH TOTAL	6299

```
MA300 RF MOD16 UHF WTG
1000 10 87 .0521 1
1 .8 .4 150 150
2 5.52 0 1 2
.85 8.021 0 1 .7
10 150
85 28 36 2.2
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

Module #16 UHF ELEMENT WEIGHTING



MODULE # 17   NAME UHF Tx

COMPLEXITY

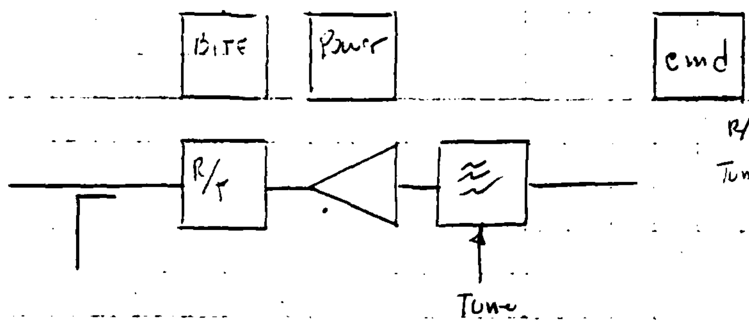
	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		10 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides Power Amplification 225-400 MHz Handles AM signal, Provides filtering ~~and~~ to R/T and BITE Test signal Coupler. Interfaces with BITE and Power buss

BLOCK DIAGRAM:



R/I 1
Tune 6

- [ ] Conduction
- [ ] Convection
- [x] FORCED AIR
- [ ] other

Size 150 in³ weight ~~4~~ 4 lbs Power dissipation: ~~AM~~ 12 watts

WEX 1

INTERFACES

Signal coax	3
" analog	
Power Buss	2
Prime Power	–
BITE	
Frequency Ref	
Control	10

Components	catalog	custom	
R/C	75		
SS	15		
IC SS	3		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid	5		
other			
TOTAL	100	0	100

circuit type

DIGITAL	10
ANALOG	10
RF/Microwave	
Transmitter	80
	100 %

PRICE COSTS

DEV	350
PROD	2285
TOTAL	2635
EACH TOTAL	1318

```
MA300 RF MOD17 UHF TRAN
2000 20 4 .0521 1
2 .8 .4 150 150
3 5.52 0 1 2
.6 8.197 0 1 .1
12 100 0 0 0
102 13 19 1 0
121 0 .862 0 0
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 18 NAME Multiband Exciter

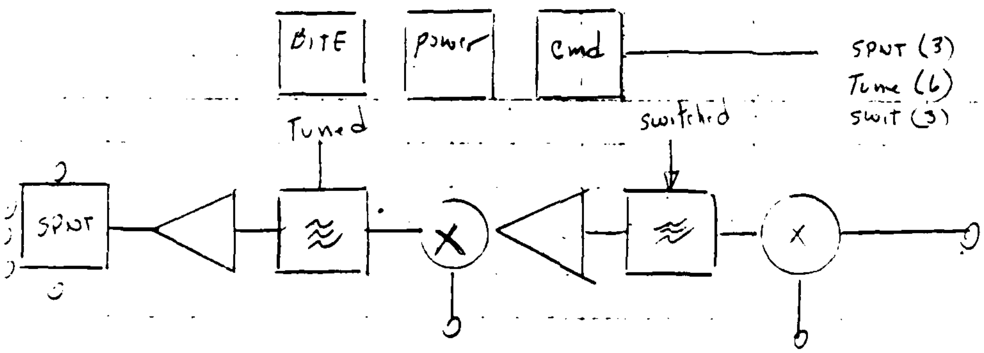
COMPLEXITY	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTISE	
NARROW	
MED	*
BROAD	

FUNCTION/SPECIFICATIONS

Accepts 70 MHz signal and generates medium level output (50 mw) at final Transmit frequency. Provides necessary filtering, translation, amplification & Routes signal to final preamplifier, interfaces with bite coupler to provide test signals. Also provides BITE, Power interfaces

BLOCK DIAGRAM:



	Conduction
	Convection
X	FORCED AIR
	other

Size 30 in³ weight 1.5 lbs Power dissipation: 6 watts

WEX 0.9

INTERFACES

Signal coax	8
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	15

Components	catalog	custom	
R/C	45		
SS	15		
IC SS	10		
IC MS	4		
IC LS			
RAM/PROM			
Hybrid	6		
other			
TOTAL	80	0	80

circuit type

DIGITAL	30
ANALOG	70
RF/Microwave	10
Transmitter	
	100 %

PRICE COSTS

DEV	293
PROD	2329
TOTAL	2623
EACH TOTAL	875

```
MA300 RF MOD18 MULTI BA EX
3000 30 1.5 .017 1
3 .8 .4 150 150
.6 5.52 0 1 2
.85 8.115 0 1 .2
6 60 0 0 0
102 13 19 1 0
121 0 .858 0 0
```

ARCHITECTURE 1 2 3 4 5 6 7

MODULE # 19 NAME VHF-AM TX

COMPLEXITY

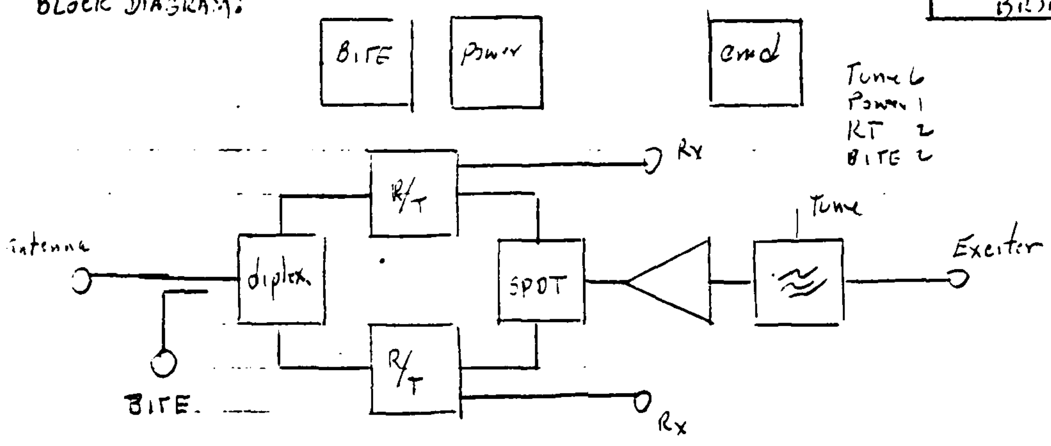
	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		10 %	

EXPERTISE	
NARROW	*
[illegible]	
BROAD	

FUNCTION/SPECIFICATIONS

Provides 30dB of power gain to AM signal, includes filtering; R/T diplexing function to common antenna provides BITE, power interfaces

BLOCK DIAGRAM:



Tune 6
Power 1
RT 2
BITE 2

	Conduction
	convection
*	FORCED AIR
	other

Size 150 in^3 weight ~~8~~ 4 lbs Power dissipation: ~~40~~ 10 watts

WEX 1 lb

INTERFACES

Signal coax	5
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	11

Components	catalog	custom	
R/C	75		
SS	15		
IC SS	3		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid	5		
other			
TOTAL	100	0	100

circuit type

DIGITAL	10
ANALOG	10
RF/Microwave	
Transmitter	80
	100 %

PRICE COSTS

DEV	302
PROD	1480
TOTAL	1782
EACH TOTAL	1782

```
MA300 RF MOD19 VHF AM TRAN
1000 10 4 .0521 1
1 .8 .4 150 150
3 5.52 0 1 2
.6 8.196 0 1 .1
10 100
102 13 19 1
121 0 .8782
```

ARCHITECTURE 1 2 3 4 5 6 7

MODULE # 20 NAME VHF/FM Tx

COMPLEXITY

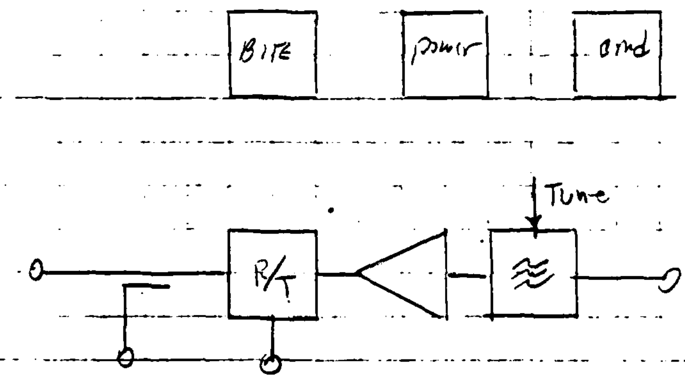
	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		15 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides filtering, 30 dB power gain and R/T of FM signal, Provides interfaces with BITE, Power and BITE coupler

BLOCK DIAGRAM:



Tune (6)
R/T (1)
Pow (4)
BITE (2)

	Conduction
	convection
X	FORCED AIR
	other

Size 120 in³ weight 3 lbs Power dissipation: 8 watts

W.E / 1

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	12 bits

Components	catalog	custom	
R/C	70		
SS	15		
IC SS	3		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid	3		
other			
TOTAL	93	0	93

circuit type

DIGITAL	10
ANALOG	15
RF/MICROWAVE	
Transmitter	75
	100 %

PRICE COSTS

DEV	279
PROD	1410
TOTAL	1689
EACH TOTAL	1689

```
MA300 RF MOD20 UHF FM TRAN
1000 10 3 .034 1
1 .8 .4 150 150
2 5.52 0 1 2
.6 8.2 0 1 .15
8 93
102 13 19 1
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 21 NAME HF Tx

COMPLEXITY

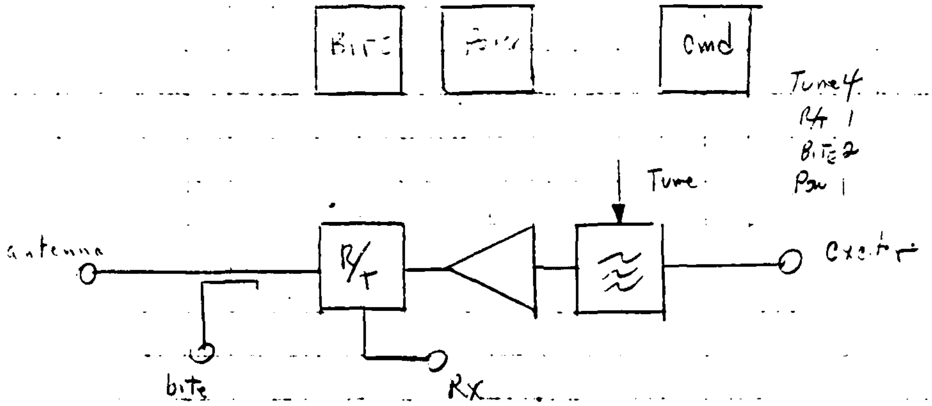
	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		15 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides filtering and linear amplification (46 dB) of exciter output. also provide BITE, Power R/T interface functions

BLOCK DIAGRAMS



	Conduction
	Convection
X	FORCED AIR
	other

Size 180 in^3 weight ~~10~~ 6 lbs Power dissipation: ~~100~~ 80 watts

WEX 1

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
Control	8 bits

Components	catalog	custom	
R/C	80		
SS	10		
IC SS	5		
IC MS	3		
IC LS			
RAM/PROM			
Hybrid	2		
other			
TOTAL	100	0	100

circuit type

DIGITAL	10
ANALOG	30
RF/MICROWAVE	
Transmitter	60
	100 %

PRICE COSTS

DEV	3 1 1
PROD	1 6 1 8
TOTAL	1 9 2 8
EACH TOTAL	1 9 2 8

```
MA300 RF MOD21 HF TRAN
1000 10 6 .0868 1
1 .8 .4 150 150
5 5.52 0 1 2
.6 8.196 0 1 .15
80 100
102 13 19 1
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 22 NAME DUAL TUNABLE VHF AM PREAMP

COMPLEXITY

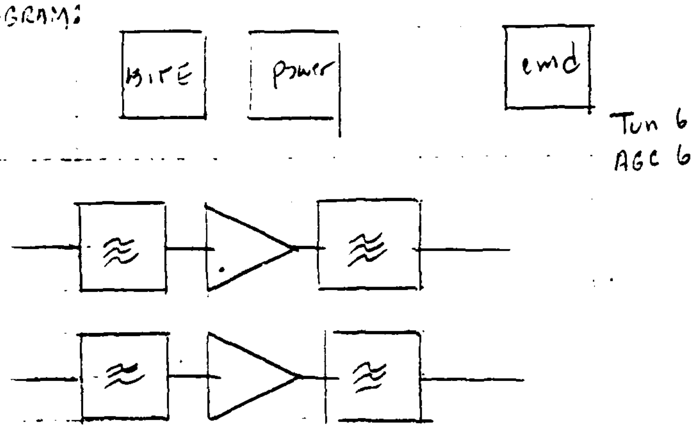
	MOD	New	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS		50 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides Tunable narrowband Filtering/amplification over 108-176 MHz band, Includes AGC, BITE, power interface

BLOCK DIAGRAM:



	Conduction
	Convection
X	FORCED AIR
	Other

Size 30 in³ weight 1.25 lbs Power dissipation: 3 watts

WEX 0.5

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
Control	27 bits

Components	catalog	custom	
R/C	90		
SS	20		
IC SS	3		
IC MS	3		
IC LS			
RAM/PROM	2		
Hybrid	2		
other			
TOTAL	120	0	120

circuit type

DIGITAL	20
ANALOG	30
RF/MICROWAVE	50
Transmitter	
	100 %

PRICE COSTS

DEV	178
PROD	1425
TOTAL	1604
EACH TOTAL	802

```
MA300 FF MOD22 VHF AM DUALT FREAMF
2000 20 1.25 .017 1
2 .8 .4 150 150
.625 5.52 0 1 2
.7 8.226 0 1 .4
3 120 0 0 0
102 13 19 1 0
121 0 .862 0 0
```

ARCHITECTURES: 1 2 3 4 5 6 7

MODULE # 23 NAME Dual tunable VHF/FM Preamp

FUNCTION/SPECIFICATIONS

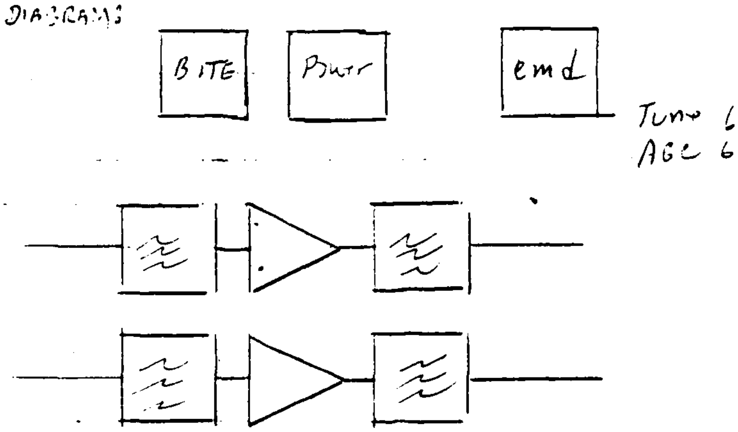
PROVIDES Tunable Narrowband filtering/amplification over 30-76 MHz band. Includes AGC, BITE, Power interface

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		50 %	

EXPERTISE	
NARROW	X
BROAD	

BLOCK DIAGRAMS



	Conduction
	Convection
X	FORCED AIR
	other

Size 30 in³ weight 1.25 lbs Power dissipation 3 watts

CNEX 0.5

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	17

Components	catalog	custom	
R/C	90		
SS	20		
IC SS	3		
IC MS	3		
IC LS			
RAM/PROM	2		
Hybrid	2		
other			
TOTAL	120	0	120

circuit type

DIGITAL	20
ANALOG	40
RF/Microwave	40
Transmitter	
	100 %

PRICE COSTS

DEV	124
PROD	816
TOTAL	939
EACH TOTAL	939

```
MA300 RF MOD23 VHF FM DUALT PREAMP
1000 10 1.25 .0174 1
1 .8 .4 150 150
.625 5.52 0 1 2
.85 8.074 0 1 .5
3 120
102 13 19 1
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 24 NAME Dual Tunable HF PREAMP

FUNCTION/SPECIFICATIONS

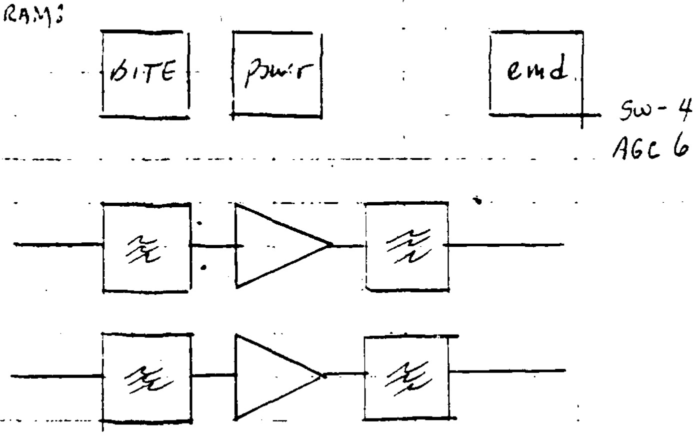
Provides Tunable narrowband amplification over 2-30 MHz band, high dynamic range. Includes AGC, Provides BITE, Power Command interfaces

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT			
complex			
DESIGN REPEATS			70

EXPERTISE	
NARROW	
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	convection
X	FORCED AIR
	other

Size 30 in³ weight 1.25 lbs Power dissipation: 4 watts

WEX 0.5

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	23

Components	catalog	custom	
R/C	80		
SS	15		
IC SS	3		
IC MS	3		
IC LS			
RAM/PROM	2		
Hybrid	2		
other			
Total	105	0	105

circuit type

DIGITAL	30
ANALOG	70
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	157
PROD	844
TOTAL	1002
EACH TOTAL	1002

```
MA300 FF MOD24 HF DUAL PREAMP
1000 10 1.25 .0174 1
1 .8 .4 150 150
.625 5.52 0 1 3
.85 8.115 0 1 .3
4 105
102 13 19 1
121 0 .8782
```

ARCHITECTURES 1 2 3 9 5 6 7

MODULE # 25 NAME TDM Coupler

FUNCTION/SPECIFICATIONS

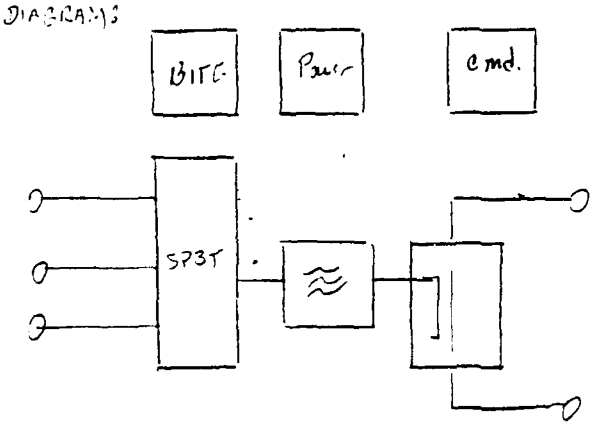
Time Division Multiplexes Narrowband signals on to FDM Buss at 70 MHz, Handles 3 inputs per module. Provides BITE, Power, Command interfaces

COMPLEXITY

	MOD	New	SOA
SIMPLE		*	
ROUTINE			
DIFFICULT			
complex			
DESIGN REPEATS		30	70

EXPERTISE	
NARROW	*
[illegible]	
BROAD	

BLOCK DIAGRAMS



	Conduction
X	convection
	FORCED AIR
	other

Size 15 in^3 weight 0.5 lbs Power dissipation 1 watts

WEX 0.1

INTERFACES

Signal coax	5
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	5 bits

Components	catalog	custom	
R/C	19		
SS	5		
IC SS	2		
IC MS	3		
IC LS			
RAM/PROM			
Hybrid	1		
other			
Total	30	0	30

circuit type

DIGITAL	50
ANALOG	50
RF/Microwave	
Transmitter	
	100 %

PRICE COSTS

DEV	95
PROD	708
TOTAL	803
[illegible]	160

```
MA300 PF MOD25 TDM CPLR
5000 50 .5 .0067 1
5 .6 .4 150 150
.4 5.52 0 1 2
.85 6.179 0 1 2
1 30.
103 12 16 .9
121 0 .654
```

[illegible] 2 3 4 5 6 7

MODULE # 26 NAME Dual FDM coupler

FUNCTION/SPECIFICATIONS

Provides conversion of 70 MHz wideband signal onto FDM Buss with minimum mutual interference

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		LS	70

EXPERTISE	
NARROW	*
BROAD	

BLOCK DIAGRAMS

See attached

	Conduction
	Convection
X	FORCED AIR
	other

Size 30 in^3 weight 1.5 lbs Power dissipation: 4 watts

WEX 0.75

INTERFACES

Signal coax	7
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
Control	13 bits

Components	catalog	custom	
R/C	120		
SS	16		
IC SS	15		
IC MS	5		
IC LS			
RAM/PROM	2		
Hybrid	2		
other			
TOTAL	160	0	160

circuit type

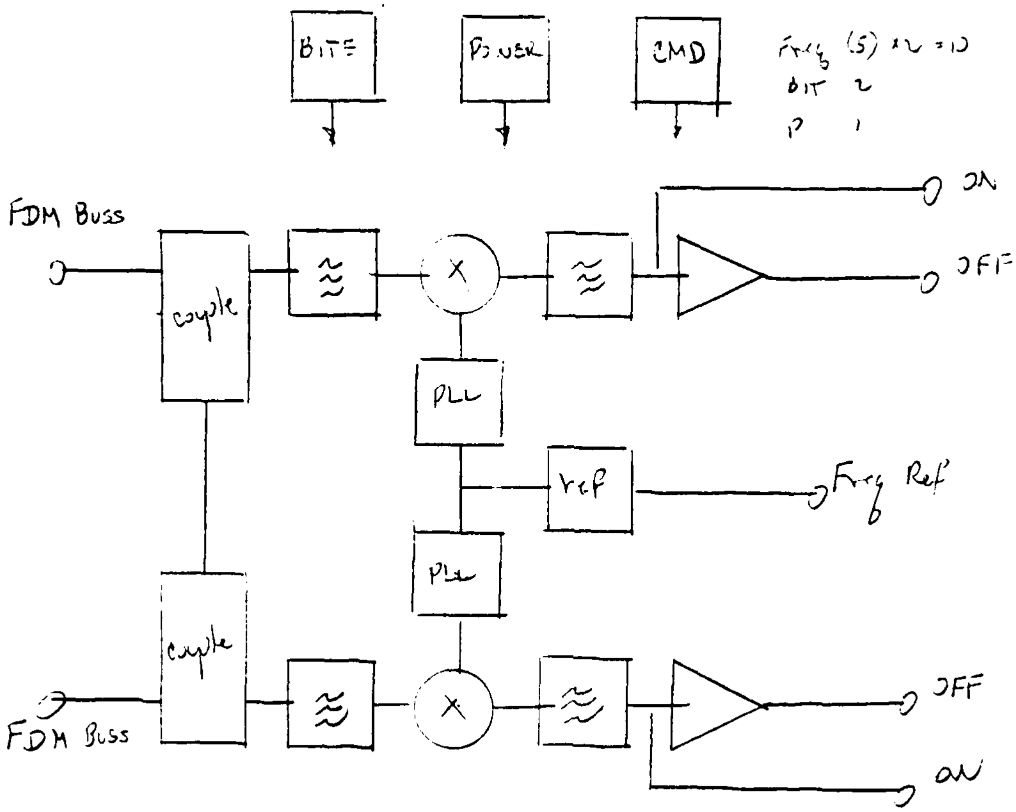
DIGITAL	50
ANALOG	50
RF/MICROWAVE	
Transmitter	
	100 %

PRICE COSTS

DEV	501
PROD	5354
TOTAL	5855
EACH TOTAL	530

```
MA300 RF MOD26 DUAL FDM CPLR
11000 110 1.5 .0174 1
11 .8 .4 150 150
.75 5.52 0 1 2
.85 8.176 0 1 .15
4 160
102 13 19 1
121 0 .838
```

ARCHITECTURES 1 2 3 4 5 6 7



DUAL FDM Coupler

MODULE #26

MODULE # 27 NAME STANDALONE Power Converter

FUNCTION/SPECIFICATIONS

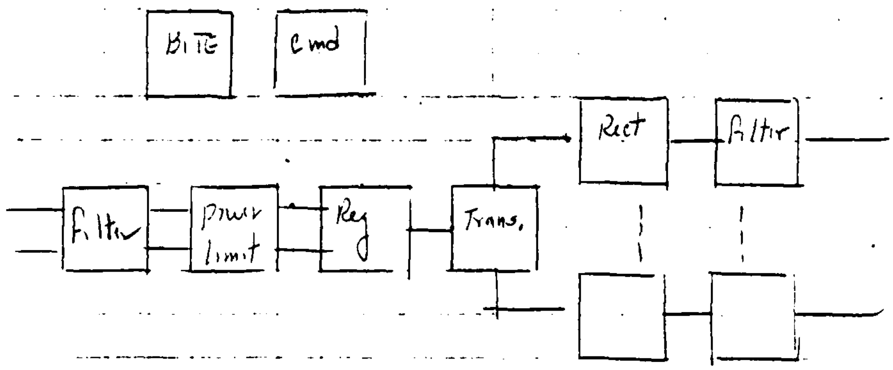
Interfaces with prime power and provides up To 5 coarsely regulated voltages with current limiting and provisions for summation provides 350 w output

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
COMPLEX			
DESIGN REPORTS		20 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	Convection
X	FORCED AIR
	other

Size 300 in³ weight ~~15~~ 6 lbs Power dissipation 70 watts

INTERFACES	
Signal coax	
" analog	
Power Buss	5
Prime Power	2
BITE	1
Frequency Ref	
control	1 bit

Components	catalog	custom	
R/C	50		
SS	12		
IC SS	8		
IC MS	6		
IC LS	2		
RAM/PROM			
Hybrid	12		
other			
TOTAL	90	0	90

circuit type	
DIGITAL	20
ANALOG	80
RF/Microwave	
Transmitter	
	100 %

DEV	258
PROD	8468
TOTAL	9325
EACH TOTAL	1555

```
MA300 RF MOD27 STAL PWR CONV
6000 60 15 6 .1736 1
1 .8 .4 150 150
5.52 0 1 2
.65 8.073 0 1 .2
70 90 -
102 13 19 1
121 0 .8525
```

ARCHITECTURES 1 2 3 4 3 9 7

MODULE # 30 NAME BITE coupler

FUNCTION/SPECIFICATIONS

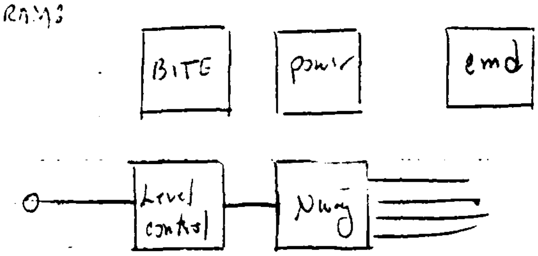
Provides Level control and distribution of bite signal generate by Multiband exciter

COMPLEXITY

	MOD	New	SOA
SIMPLE		*	
ROUTINE			
DIFFICULT			
complex			
DESIGN REPEATS		15 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAMS



Level 6
BITE 2
Power 4

	Conduction
X	Convection
	FORCED AIR
	other

Size 15 in^3 weight 0.5 lbs Power dissipation: 2 watts

cover 0.25

INTERFACES

Signal coax	9
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	9 bits

Components	catalog	custom	
R/C	15		
SS	2		
IC SS	4		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid	2		
other			
Total	25	0	25

circuit type

DIGITAL	50
ANALOG	50
RF/MICROWAVE	
Transmitter	
	100 %

PRICE COSTS

DEV	90
PROD	405
TOTAL	495
EACH TOTAL	495

```
MA300 FF MOD30 BITE CPLR
1000 10 .5 .0087 1
1 .8 .4 150 150
.25 5.53 0 1 2
.85 8.177 0 1 .15
2 25
103 12 18 .9
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

MODULE # 33(4) NAME Dual RF Buss Driver

FUNCTION/SPECIFICATIONS

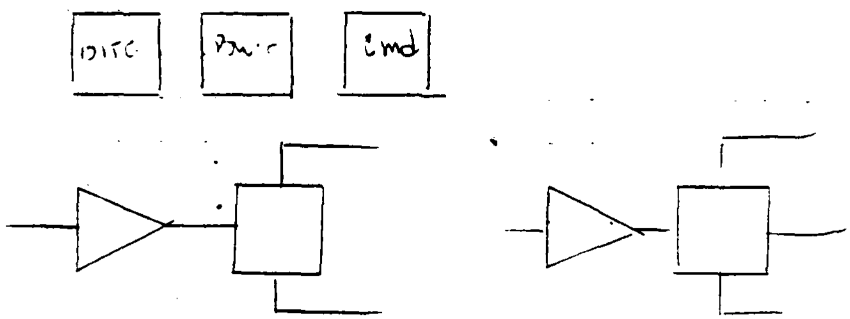
High dynamic range amplifier/coupler used to couple RF signal onto the RF Buss. Must have 30dB of amplifier gain into 15dB coupler with output capability of >1watt linear, 8-10dB NF

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
COMPLEX			
DESIGN REPEATS		20 %	

EXPERTIZE	
NARROW	*
YES	
BROAD	

BLOCK DIAGRAMS



	Conduction
	Convection
X	FORCED AIR
	other

Size 30 in^3 weight 1.25 lbs Power dissipation: 15 w watts

WEX 0.5

INTERFACES

Signal coax	3
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
Control	3 bits

Components	catalog	custom
R/C	100	
SS	12	
IC SS	4	
IC MS	3	
IC LS		
RAM/PROM		
Hybrid	4	
other		
TOTAL	123	

circuit type

DIGITAL	10
ANALOG	20
RF/MICROWAVE	70
Transmitter	
	100 %

PRICE COSTS

DEV	1466
PROD	7354
TOTAL	8820
EACH TOTAL	588

GPS - 2000
ST/UHF 4000
VHF AM 4000
VHF FM ~~2000~~
HF 2000
LBand 1000

```
MA300 RF MOD331 GPS DUAL RF BD
2000 20 1.25 .017 1
2 .8 .4 150 150
.75 5.52 0 1 2
.85 8.021 0 1 .4
15 123 0
96 19 25 1.5
121 0 .362
```

ARCHITECTURES 1 2 3 4 5 6 7

1122

MODULE # 36 NAME FREQUENCY REF

COMPLEXITY

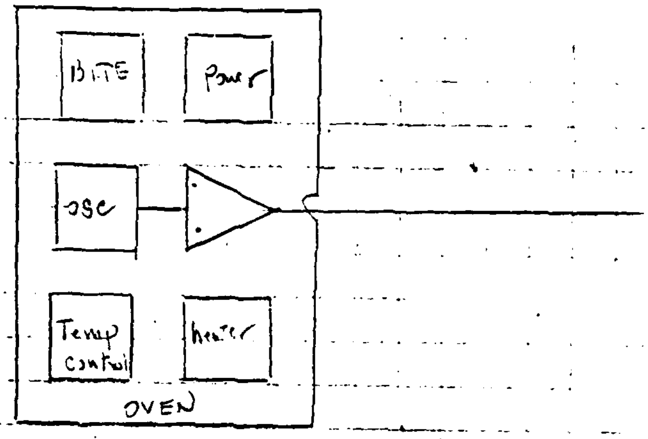
	MOD	New	SOA
SIMPLE		*	
ROUTINE			
DIFFICULT			
complex			
DESIGN REPEATS		10	7?

EXPERTISE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

PROVIDES STABLE FREQUENCY for use by synthesizers. Includes BITE and Power interfaces including standby condition

BLOCK DIAGRAM:



	Conduction
	Convection
	FORCED AIR
	other

size 60 in³ weight 1.5 lbs Power dissipation: 6 (ave) watts

WEX

INTERFACES

Signal coax	1
" analog	
Power Buss	1
Prime Power	
BITE	1
Frequency Ref	
Control	4 bits

Components	catalog	custom	
R/C	54		
SS	10		
IC SS	4		
IC MS	2		
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL	70	0	70

circuit type

DIGITAL	25
ANALOG	75
RF/MICROWAVE	
Transmitter	
	100 %

PRICE COSTS

DEV	167
PROD	818
TOTAL	985
EACH TOTAL	985

```
MA300 RF MOD36 FREQ REF
1000 10 1.5 .0347 1
1 .8 .4 150 150
.9 5.52 0 1 2
.85 6.096 0 1 .1
6 70
103 12 18 .9
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7

Modified 9/27

MODULE # 11 NAME VHF/UHF PREAMP

FUNCTION/SPECIFICATIONS

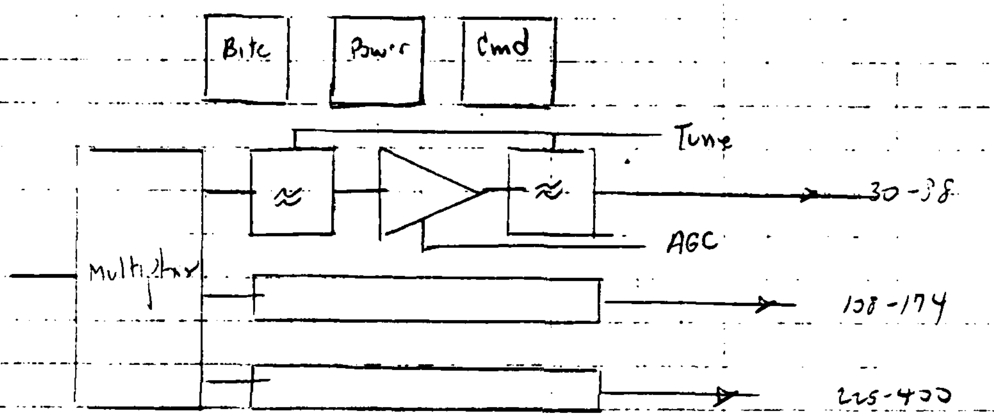
separates antenna signal into 30-88, 108-174, 225-400 MHz bands. Provides Tunable low noise, preamp for each band. Provides BITE, Power, Cmd interfaces

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	convection
	FORCED AIR
	other

Size 5x6x1 in³ weight ~~2.5~~ 2.0 lbs Power dissipation: ~~2.2~~ 3.5 watts

WEX ~~0.3~~ lbs

INTERFACES

Signal coax	4
" analog	
Power Buss	2
Prime Power	
BITE	
Frequency Ref	
Control	40 bits

1.0 Components

	catalog	custom	
R/C	120		
SS	16		
IC SS	10		
IC MS	8		
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL	154		

circuit type

DIGITAL	20
ANALOG	10
RF/MICROWAVE	70
Transmitter	
	100 %

PRICE COSTS

DEV	326
PROD	2540
TOTAL	2866
EACH TOTAL	955

```
MA600 RF MOD11 UHF UHF PREAMP
3000 30 2 .017 1
3 .8 .4 150 150
1 5.52 0 1 2
.85 8.075 0 1 .2
3.5 154 0
102 13 19 1
121 0 .8585
1978 0 1 1 1
1.8 1 1 1 1
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

M 9/27

MODULE # 12 NAME L BAND PREAMPS wide

COMPLEXITY

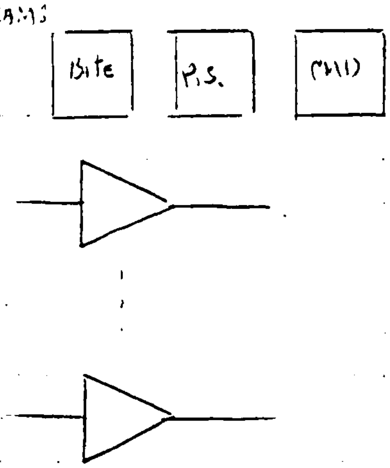
	MOD	New	OOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		85	7%

EXPERTISE	
NARROW	X
MED	
BROAD	

FUNCTION/SPECIFICATIONS

THIS MODULE contains 5 wideband Preamps 962-1554 MHz all Identical. High dynamic range, good NF

BLOCK DIAGRAMS



☐	Contact on
☐	convection
☐	FORCED AIR
☐	other

Size 5x6x~~X~~ 1 in³ weight ~~.85~~ 1.5 lbs Power dissipation: ~~4.6~~ 3.7 watts

WEX ~~.4~~ 0.8 lbs

INTERFACES

Signal coax	10
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	3 bits

Components	catalog	custom	
R/C	40		
SS	5		
IC SS			
IC MS	3		
IC LS			
RAM/PROM			
Hybrid	5		
other			
Total	53		

circuit type

DIGITAL	10
ANALOG	10
RF/Microwave	80
Transmitter	
	100%

PRICE COSTS

DEV	140
PROD	1981
TOTAL	2121
EACH TOTAL	707

```
MA600 RF MOD12 L FREAMF WIDE
3000 30 1.5 .009 1
3 .8 .4 150 150
.7 5.52 0 1 2
.85 8.02 0 1 .85
3 53
102 13 19 1
121 0 .8585
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

M 9/27

MODULE # 13 NAME UHF Preamps

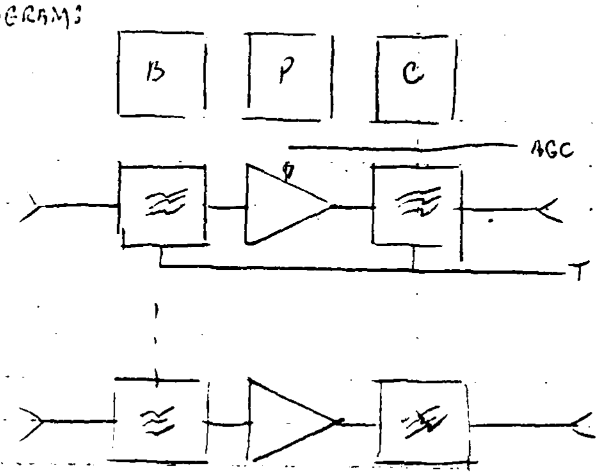
FUNCTION/SPECIFICATIONS

This module contains 5 preamps tunable 225-400 Similar to module 11 except all are same frequency and no multiplexer is required.

COMPLEXITY	MOD	NEW	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS		80 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	CONDUCTION
	CONVECTION
	FORCED AIR
	OTHER

Size 5x6x1 in³ weight 1.5 lbs Power dissipation: ~~35~~ 3.5 watts

WEX ~~23~~ 3.4 lbs

INTERFACES

Signal coax	10
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
Control	15 bits

Components	catalog	custom
R/C	140	
SS	20	
IC SS	15	
IC MS	4	
IC LS		
RAM/PROM		
Hybrid		
other		
Total	179	

Circuit type

DIGITAL	20
ANALOG	10
RF/Microwave	70
Transmitter	
	100 %

PRICE COSTS

DEV	71
PROD	614
TOTAL	684
EACH TOTAL	684

```
MA600 RF MOD13 UHF PREAMP
1000 10 1.5 .017 1
1 .6 .4 150 150
1.1 5.52 0 1 2
.85 8.075 0 1 .8
3.5 179
102 13 19 1
121 0 .8782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # 14 NAME L Band Preamps Narrow

COMPLEXITY

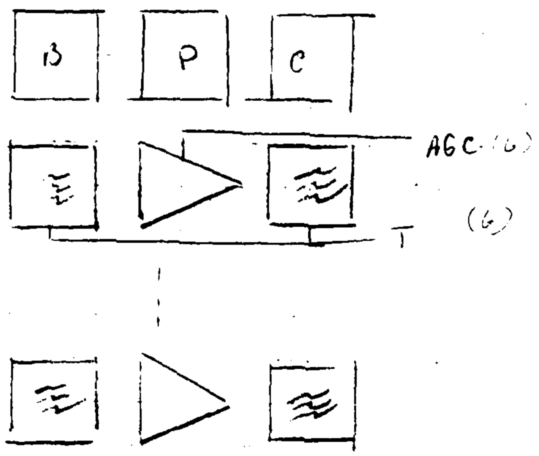
	MOD	New	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS		80	7

EXPERTISE	
NARROW	X
MED	
BROAD	

FUNCTION/SPECIFICATIONS

4 tunable (960-1215 MHz) narrow band preamps

BLOCK DIAGRAM:



	Convection
	Conduction
	FORCED AIR
	other

Size 5x6x1 in^3 weight 1.5 lbs Power dissipation: ~~22~~ 3.5 watts

WEX ~~2.8~~ 0.9 lbs

INTERFACES

Signal coax	?
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	52 bits

Components	catalog	custom
R/C	130	
SS	16	
IC SS	12	
IC MS	10	
IC LS		
RAM/PROM		
Hybrid		
other		
TOTAL	168	

circuit type

DIGITAL	10
ANALOG	10
RF/Microwave	80
Transmitter	
	100 %

PRICE COSTS

DEV	128
PROD	1600
Total	1728
EACH TOTAL	864

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

```
MA600 RF MOD 14 L PREAMP NARROW
2000 20 1.5 .017 1
2 .8 .4 150 150
.6 5.52 0 1 2
.85 8.021 0 1 .8
3.5 168
102 13 19 1
121 0 .8619
```

~~Arch~~ H 9/27

MODULE # 21 NAME Multiband down converter

FUNCTION/SPECIFICATIONS

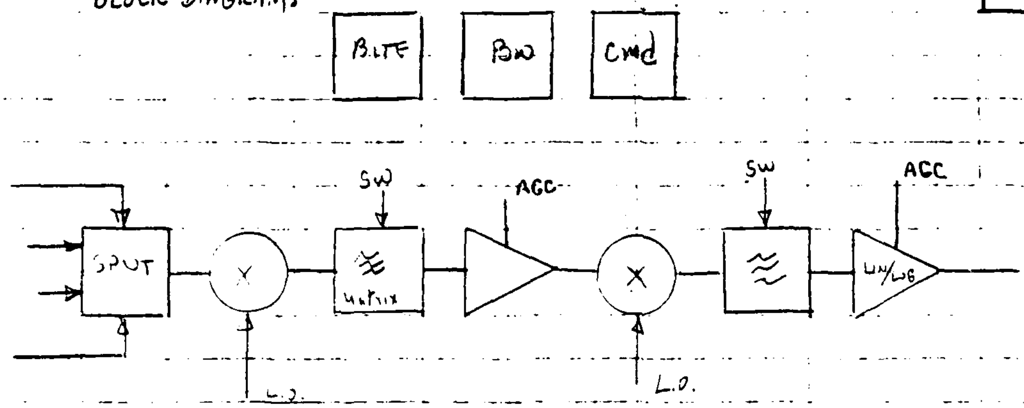
Provides down conversion of any signal in 2-30, 30-88, 108-124, 225-400, 963-1215, 1227, 1554 MHz bands to common 70 MHz IF output, at ~10 dBm. Includes switch filters, AGC, BITE power, command

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
COMPLEX			
DESIGN REPEATS		20 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	Convection
	FORCED AIR
	other

Size ~~5x6x1½ in³~~ (45 cu") weight ~~4.5~~ 2.5 lbs Power dissipation ~~3.0~~ 5.0 watts

WEX ~~0.4~~ 1.5

INTERFACES

Signal coax	7
" analog	
Power Buss	3
Prime Power	
BITE	1
Frequency Ref	
control	25 bits

Components	catalog	custom
R/C	100	
SS	10	
IC SS	6	
IC MS	6	
IC LS		
RAM/PROM		
Hybrid	19	
other		
TOTAL	141	

circuit type

DIGITAL	20
ANALOG	20
RF/MICROWAVE	60
Transmitter	
	100 %

PRICE COSTS

Dev	1067
PROD	12187
Total	13254
ENG. STAND.	800

```
MA600 FF MOD21 MUBD DOWN CONV
17000 170 2.5 .036 1
17 .8 .4 150 150
1 5.52 0 1 2
.85 8.075 0 1 .2
5 141
102 13 19 1
121 0 .6344
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

M 9/87

MODULE # 31 NAME Multiband Exciter

FUNCTION/SPECIFICATIONS

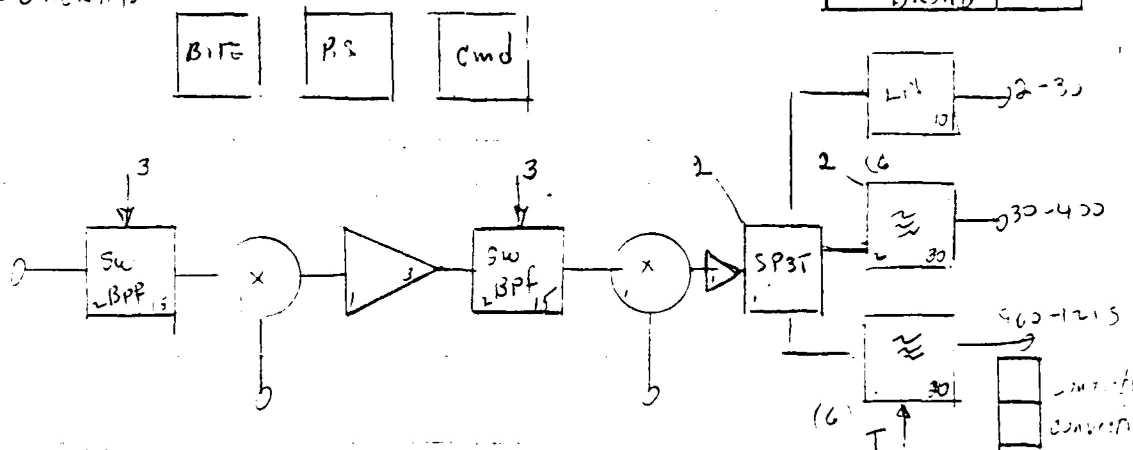
Provides up conversion from 70 MHz to desired output frequency. Similar to down converter except much less gain and requires output filtering

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS		20 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAMS



	conduction
	convection
	FORCED AIR
	other

Size ~~5x6x1½ in³~~ 45 cu" weight ~~1.5~~ 2.0 lbs Power dissipation: ~~3.2~~ 4.5 watts

WEX ~~2.4~~ lbs

INTERFACES

Signal coax	6
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
Control	24 bits

1.0

Components	catalog	custom
R/C	120	
SS	20	
IC SS	3	
IC MS	6	
IC LS		
RAM/PROM		
Hybrid	10	
other		
Total	159	

circuit type

DIGITAL	20
ANALOG	20
RF/Microwave	60
Transmitter	
	100 %

PRICE COSTS

DEV.	313
PROD	2537
TOTAL	2850
EACH TOTAL	750

```
MA600 PF MOD31 MUBD EX
3000 30 2 .026 1
3 .8 .4 150 150
1 5.52 0 1 2
.85 8.075 0 1 .3
4.5 157
102 13 19 1
121 0 .8585
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # 41 NAME VHF/UHF Pwr Amp

FUNCTION/SPECIFICATIONS

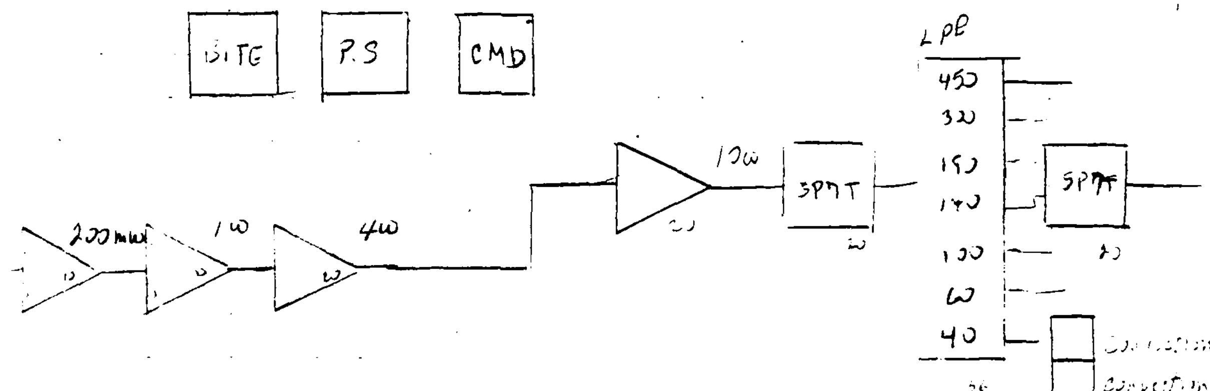
Provides 30 dB gain LPF to AM and FM signals in 30-88, 138-174, 225-400 bands

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		10	70

EXPERTIZE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAMS



	Conduction
	Convection
	FORCED AIR
	other

Size 5 x 6 x 4 in^3 weight 5.0 lbs Power dissipation 25 watts

WEX 1.0 lbs

INTERFACES

Signal coax	2
" analog	
Power Buss	3
Prime Power	
BITE	
Frequency Ref	
Control	10 bits

Components	catalog	custom
R/C	180	
SS	35	
IC SS	2	
IC MS	2	
IC LS		
RAM/PROM		
Hybrid	4	
other		
TOTAL	223	

circuit type	
DIGITAL	20
ANALOG	20
RF/MICROWAVE	
Transmitter	60
	100 %

DEV	3 0 8
PROD	2 4 4
TOTAL	2 8 1 4
EA ... TOTAL	1 4 0 7

```
MA600 FF MOD41 VHF UHF PWR AMP
2000 20 5 .069 1
2 .9 .4 150 150
4 5.52 0 1 2
.6 6.231 0 1 .1
25 223
102 13 19 1
121 0 .3619
1976 0 1 1 1
1.6 1 1 1 1
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

AD-A082 956 GENERAL DYNAMICS SAN DIEGO CALIF ELECTRONICS DIV F/G 17/2.1
MULTIFUNCTION MULTIBAND AIRBORNE RADIO SYSTEM MFBARS.(U)
OCT 78 F33615-78-C-1517
UNCLASSIFIED R-78-055 NL

4 of 6
AD
A082956

MODULE # 42 NAME HF R/T

COMPLEXITY

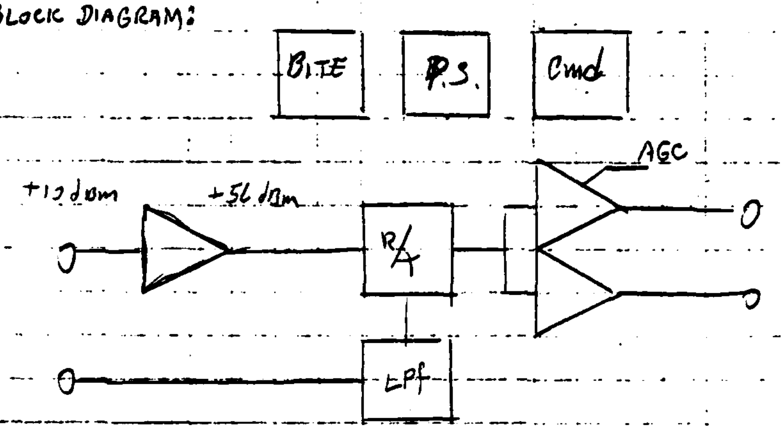
	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		30	%

EXPERTIZE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

Provides power Amplifier, R/T and Dual output HF preamp signals. Interfaces with exciter/antenna and two receiver channels, Provides preselection BITE, power and cmd functions

BLOCK DIAGRAM:



	Conduction
	convection
*	FORCED AIR
	other

(152)

Size 5×6×5 in³ weight 12 lbs Power dissipation: 110W watts

WEX 0.5 lbs

INTERFACES

Signal coax	4
" analog	
Power Buss	3
Prime Power	
BITE	1
Frequency Ref	
control	17 bits

Components	catalog	custom	
R/C	120		
SS	20		
IC SS	8		
IC MS	4		
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL	152		

circuit type

DIGITAL	20
ANALOG	20
RF/MICROWAVE	
Transmitter	60
	100 %

PRICE COSTS

DEV	236
PROD	1479
Total	1716
EACH TOTAL	1716

```
MA600 RF MOD42 HF RT
1000 10 12 .087 1
1 .8 .4 150 150
11.5 5.52 0 1 2
.6 8.233 0 1 .3
110 152
102 13 19 1
121 0 .8782
```

ARCHITECTURE 1 2 3 4 5 6 7 8 9 10

MODULE # 43 NAME: L BAND Power Amp

COMPLEXITY

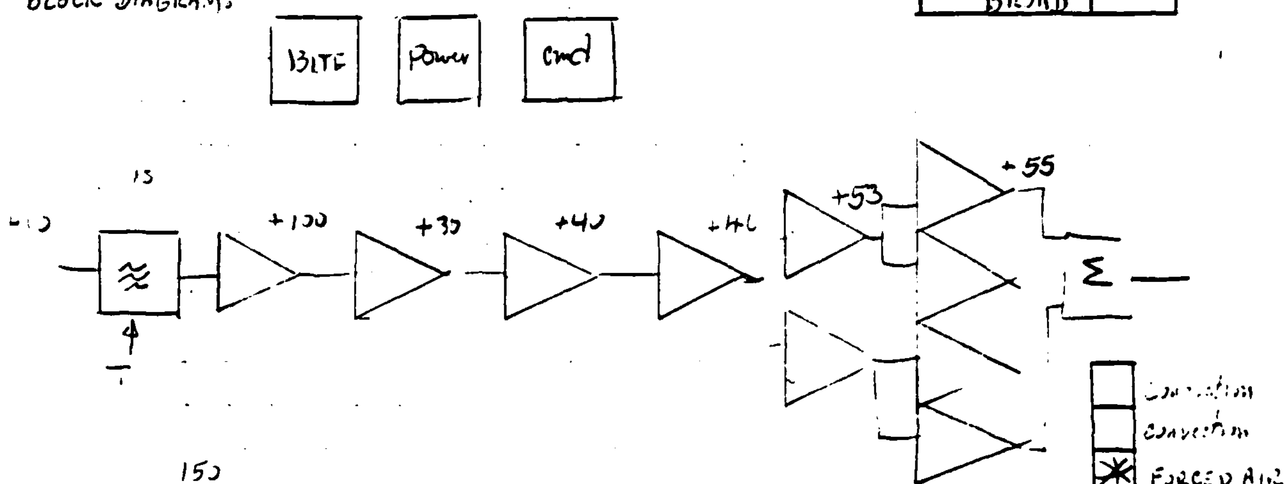
	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
complex			
DESIGN REPEATS		10	%

EXPERTISE	
NARROW	
MED	*
BROAD	

FUNCTION/SPECIFICATIONS

Provides JTIDS, IFF, TACAN pulses with rating selected antenna (out of 5).

BLOCK DIAGRAM:



Size 5x6x5 in³ (150) weight 11 lbs Power dissipation: 100 watts

WEX 1.5 lbs

INTERFACES

Signal coax	2
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
Control	13 bits

Components	catalog	custom	
R/C	190		
SS	25		
IC SS	10		
IC MS	5		
IC LS			
RAM/PROM			
Hybrid	5		
other			
TOTAL	235		

circuit type

DIGITAL	5
ANALOG	10
RF/MICROWAVE	
Transmitter	85
	100 %

PRICE COSTS

DEV	731
PROD	2394
TOTAL	3126
FAC. TOTAL	3126

```
MA600 PF MOD43 L PWR AMP
1000 10 11 .067 1
T .8 .4 150 150
9.5 5.52 0 1 2
.5 8.177 0 1 .1
100 235
95 20 26 1.5
121 0 .5782
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # 61 NAME UHF/LBAND Multi

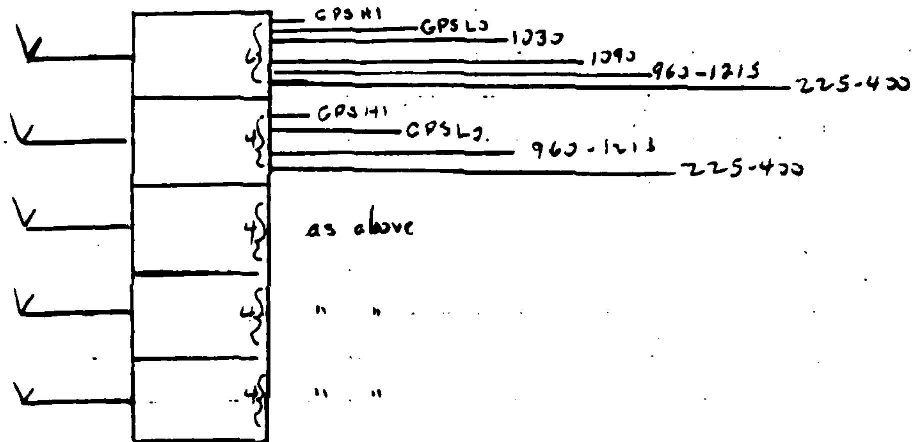
FUNCTION/SPECIFICATIONS

Separates antenna signal into 6 (4) bands
passive

COMPLEXITY	MOD	New	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
complex			
DESIGN REPEATS		60 %	

EXPERTIZE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	Convection
	FORCED AIR
	other

Size 5x6x3 in^3 weight 3 lbs Power dissipation: 0 W-TE
WEX 0.2 lbs

INTERFACES

Signal coax	27
" analog	
Power Buss	2
Prime Power	
BITE	1
Frequency Ref	
control	0

Components	catalog	custom	
R/C	220		
SS			
IC SS			
IC MS			
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL	220		

circuit type

DIGITAL	
ANALOG	20
RF/MICROWAVE	80
Transmitter	
	100 %

PRICE COSTS

DEV	[illegible]
PROD	872
TOTAL	1261
EACH TOTAL	530

```
MA600 RF MOD61 UHF L MULTI
2000 20 3 .052 1
2 .8 .4 150 150
2.8 5.52 0 1 2
.8 8.211 0 1 .6
.01 220
95 20 26 1.5
121 0 .8619
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

~~2000~~

MODULE # 62 NAME UHF/LBAND Diplexer

FUNCTION/SPECIFICATIONS

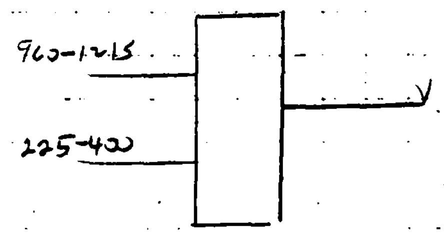
diplexer UHF/LBand Txmit signals on common antenna

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
COMPLEX			
DESIGN REPEATS		20 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAM:



	Conduction
	Convection
	FORCED AIR
	other

Size 5x6x½ in³ weight 1.0 lbs Power dissipation: 0 watts
WEX 0.1 lbs

INTERFACES

Signal coax	3
" analog	
Power Buss	0
Prime Power	
BITE	0
Frequency Ref	
control	0

Components	catalog	custom	
R/C	20		
SS			
IC SS			
IC MS			
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL	20		

circuit type

DIGITAL	
ANALOG	20
RF/Microwave	80
Transmitter	
	100 %

PRICE COSTS

Dev	89
PROD	461
TOTAL	549
EACH TOTAL	275

```
MA600 RF MOD62 UHF L DIPL
2000 20 1 .009 1
2 .8 .4 150 150
.9 5.52 0 1 2
.8 8.211 0 1 .2
.01 20
102 13 19 1
121 0 .8619
```

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

~~[illegible]~~

alt 3

MODULE # 101 NAME NBSP Analog

FUNCTION/SPECIFICATIONS

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		10 %	

EXPERTISE	
NARROW	X
MED	*
BROAD	

BLOCK DIAGRAM:

	conduction
	convection
X	FORCED AIR
	other

Size 30 in^3 weight 1 lbs Power dissipation: 7 watts

WEX ______ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C			
SS			
IC SS			
IC MS			
IC LS			
RAM/PROM			
Hybrid			
other			
Total			

circuit type

DIGITAL	20
ANALOG	80
RF/MICROWAVE	
Transmitter	
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Omam 2000

MODULE # 10~~3~~ 1 NAME NBSP Digital No. 1

FUNCTION/SPECIFICATIONS

COMPLEXITY	MOD	NEW	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
COMPLEX			
DESIGN REPEATS			0 %

EXPERTISE	
NARROW	X
[illegible]	
BROAD	

BLOCK DIAGRAM:

	conduction
	convection
X	FORCED AIR
	other

Size 30 in³ weight 1 lbs Power dissipation 7 W

WEX lbs

INTERFACES

Signal coax

" analog

Power Buss

Prime Power

BITE

Frequency Ref

Control

Components	catalog	custom	
R/C			
SS			
IC SS			
IC MS			
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL			

circuit type

DIGITAL

ANALOG

RF/Microwave

Transmitter

100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Quan. 2000

MODULE # ~~10~~ 103 NAME NBSP Digital No. 2

FUNCTION/SPECIFICATIONS

BLOCK DIAGRAM:

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
complex			
DESIGN REPEATS	10%		

EXPERTISE	
NARROW	X
MED	
BROAD	

	Conduction
	Convection
X	FORCED AIR
	other

Size 30 in^3 weight 1 lbs Power dissipation: 7 watts

WEX lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C			
SS			
IC SS			
IC MS			
IC LS			
RAM/PROM			
Hybrid			
other			
TOTAL			

circuit type

DIGITAL	
ANALOG	
RF/Microwave	
Transmitter	
	100%

Quan. 2000

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # 111 NAME WBSP DETECTOR

FUNCTION/SPECIFICATIONS

COMPLEXITY	MOD	NEW	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
COMPLEX			
DESIGN REPEATS		10 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

BLOCK DIAGRAMS

	conduction
	convection
X	FORCED AIR
	other

SIZE 30 in³ weight 1 lbs Power dissipation: 20 watts

WEX ___ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	10%		
SS			
IC SS	60%		
IC MS			
IC LS		20%	
RAM/PROM			
Hybrid		10%	
other			
TOTAL			

circuit type

DIGITAL	30
ANALOG	60
RF/MICROWAVE	10
Transmitter	—
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Quan 4000

MODULE # 112 NAME WBSP EVENT DETECTOR

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS	10 %		

EXPERTISE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

BLOCK DIAGRAM:

- [ ] conduction
- [ ] convection
- [x] FORCED AIR
- [ ] other

size 30 in^3 weight 1 lbs Power dissipation: 20 watts

WEX ____ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	5%		
SS			
IC SS	10%		
IC MS			
IC LS	20%	50%	
RAM/PROM			
Hybrid		15%	
other			
TOTAL			

circuit type

DIGITAL	100
ANALOG	—
RF/Microwave	—
Transmitter	—
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Quan 1000

MODULE # 113 NAME WBSP SECURE DATA UNIT & MEMORY COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE			
DIFFICULT		*	
COMPLEX			
DESIGN REPEATS		10 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

BLOCK DIAGRAMS

	conduction
	convection
X	FORCED AIR
	other

Size 30 in^3 weight 1 lbs Power dissipation: 20 watts

WEX ______ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	5%		
SS			
IC SS	10%		
IC MS			
IC LS	20%	40%	
RAM/PROM			
Hybrid		25%	
other			
TOTAL			

circuit type

DIGITAL	100
ANALOG	—
RF/Microwave	—
Transmitter	—
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Quan. 1200

MODULE # 114 NAME WBSP EVENT PROCESSOR

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS		10 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

BLOCK DIAGRAM:

	conduction
	convection
X	FORCED AIR
	other

Size 30 in^3 weight 1 lbs Power dissipation: 20 watts

WEX ____ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	5%		
SS			
IC SS	20%		
IC MS			
IC LS		60%	
RAM/PROM			
Hybrid		25%	
other			
TOTAL			

circuit type

DIGITAL	100
ANALOG	—
RF/Microwave	—
Transmitter	—
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Quan. 2000

MODULE # 115 NAME ~~WBSP~~ EVENT SCHEDULER & DECODER

COMPLEXITY

	MOD	NEW	SOA
SIMPLE			
ROUTINE		X	
DIFFICULT			
COMPLEX			
DESIGN REPEATS		10 %	

EXPERTISE	
NARROW	X
MED	
BROAD	

FUNCTION/SPECIFICATIONS

BLOCK DIAGRAM:

	Conduction
	Convection
X	FORCED AIR
	other

Size 30 in^3 weight 1 lbs Power dissipation: 20 watts

WEX ___ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
control	

Components	catalog	custom	
R/C	5 %		
SS			
IC SS	10 %		
IC MS			
IC LS	20 %	50 %	
RAM/PROM			
Hybrid		15 %	
other			
Total			

circuit type

DIGITAL	100
ANALOG	—
RF/Microwave	—
Transmitter	—
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Quan. 1000

MODULE # 116 NAME WBSP TRANSMITTER

FUNCTION/SPECIFICATIONS

COMPLEXITY

	MOD	New	SOA
SIMPLE			
ROUTINE		*	
DIFFICULT			
complex			
DESIGN REPEATS	10 %		

EXPERTISE	
NARROW	*
[illegible]	
BROAD	

BLOCK DIAGRAMS

	Conduction
	convection
X	FORCED AIR
	other

Size 30 in^3 weight 1 lbs Power dissipation: 20 watts

WEX ____ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	10%		
SS			
IC SS	60%		
IC MS			
IC LS		20%	
RAM/PROM			
Hybrid		10%	
other			
TOTAL			

circuit type

DIGITAL	30
ANALOG	60
RF/Microwave	10
Transmitter	—
	100 %

Quan. 1000

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # 117 NAME WBSP REED SOLOMAN ENCODER/DECODER

FUNCTION/SPECIFICATIONS

COMPLEXITY

	MOD	New	SOA
SIMPLE		*	
ROUTINE			
Difficult			
complex			
DESIGN REPEATS		10 %	

EXPERTIZE	
NARROW	X
MED	
BROAD	

BLOCK DIAGRAM:

	Conduction
	convection
X	FORCED AIR
	other

Size 30 in^3 weight 1 lbs Power dissipation: 20 watts

WEX ____ lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	5%		
SS			
IC SS	10%		
IC MS			
IC LS		65%	
RAM/PROM			
Hybrid		20%	
other			
TOTAL			

circuit type

DIGITAL	100
ANALOG	—
RF/Microwave	—
Transmitter	—
	100 %

Quan. 1000

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

MODULE # 121 NAME CONTROL PROCESSOR MASS MEMORY

COMPLEXITY

	MOD	New	SOA
SIMPLE		*	
ROUTINE			
DIFFICULT			
COMPLEX			
DESIGN REPEATS		0 %	

EXPERTISE	
NARROW	*
[illegible]	
BROAD	

FUNCTION/SPECIFICATIONS

DUAL 1-MBYTE MASS MEMORY

BLOCK DIAGRAMS:

[illegible]	
CONVECTION	
FORCED AIR	X
OTHER	

Size 30 in³ weight 1 lbs Power dissipation: 5 W

WEX lbs

INTERFACES

Signal coax	
" analog	
Power Buss	
Prime Power	
BITE	
Frequency Ref	
Control	

Components	catalog	custom	
R/C	10%		
SS			
IC SS			
IC MS			
IC LS	90%		
RAM/PROM			
Hybrid			
other			
TOTAL			

circuit type

DIGITAL	100
ANALOG	
RF/MICROWAVE	
TRANSMITTER	
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Quan 1000

MODULE # 122 NAME CONTROL PROCESSOR MICROCOMPUTER

COMPLEXITY

	MOD	New	SOA
SIMPLE		*	
ROUTINE			
DIFFICULT			
complex			
DESIGN REPEATS		90 %	

EXPERTISE	
NARROW	*
MED	
BROAD	

FUNCTION/SPECIFICATIONS

CPU + 64K BYTES OF MEMORY + BITE + PS + BUS INTERFACE

BLOCK DIAGRAM:

- [ ] Conduction
- [ ] convection
- [ ] FORCED AIR
- [ ] other

Size 30 in^3 weight 1 lbs Power dissipation: 5 watts

WEX ___ lbs

INTERFACES

Signal coax
" analog
Power Buss
Prime Power
BITE
Frequency Ref
Control

Components	catalog	custom
R/C	10%	
SS		
IC SS		
IC MS		
IC LS	90%	
RAM/PROM		
Hybrid		
other		
TOTAL		

circuit type

DIGITAL	90
ANALOG	10
RF/Microwave	—
Transmitter	—
	100 %

ARCHITECTURES 1 2 3 4 5 6 7 8 9 10

Guzon 6/20

APPENDIX E

ACQUISITION COST SUMMARY DATA

APPENDIX E

ACQUISITION COST SUMMARY DATA

Development and production cost summaries obtained from PRICE 83B (LSKIP = 2) are presented in this Appendix. See Section 4.2 for associated discussion. All costs are $1000.

Architecture One – The following costs are for all Architecture One electronic units. MA100 in the unit title identifies Architecture One.

Architecture Two – The following costs are for unique Architecture Two electronic units. MA200 in the unit title identifies Architecture Two. These units replace some of those in Architecture One; see Section 3 for specific identification.

Architecture Three – The following costs are for all Architecture Three electronic units. MA300 in the unit title identifies Architecture Three.

Architecture Four – The following costs are for unique Architecture Four electronic units. MA400 in the unit title identifies Architecture Four units. These units along with some from other architectures are used for a complete Architecture Four; see Section 3 for specific identification.

Architecture Five – There are currently no PRICE files specifically for this architecture. Cost estimates for it are obtained by extrapolations from other architectures; see Section 3.

Architecture Six – The following costs are for unique Architecture Six electronic units. MA600 in the unit title identifies Architecture Six units. These units along with some from other architectures are used for a complete Architecture Six; see Section 3 for specific identification.

Architecture Seven – The following costs are for unique Architecture Seven electronic units. MA700 in the unit title identifies Architecture Seven units. These units along with some from other architectures are used for a complete Architecture Seven; see Section 3 for specific identification.

Antennas – The following costs are for all Architecture One antennas. These same antennas are also to be used for most other architectures; see Section 3 for specific identification.

Architecture One

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
MA100 GPS			
TOTAL COST	17729.	23316.	41045.
MA100 JTIDS 1 OF 3			
TOTAL COST	10138.	12716.	22854.
MA100 JTIDS 2 OF 3			
TOTAL COST	10138.	12716.	22854.
MA100 JTIDS 3 OF 3			
TOTAL COST	10138.	12716.	22854.
MA100 SEEKTALK			
TOTAL COST	10571.	12917.	23487.
MA100 UHFAM RT			
TOTAL COST	404.	3118.	3521.
MA100 VHFAM RT			
TOTAL COST	492.	3904.	4396.
MA100 VHFFM RT			
TOTAL COST	394.	3034.	3428.
MA100 HF RT			
TOTAL COST	671.	5541.	6212.
MA100 TACAN			
TOTAL COST	570.	5443.	6013.
MA100 ILS VOR			
TOTAL COST	374.	2767.	3141.
MA100 COM CRYP			
TOTAL COST	296.	2132.	2429.
MA100 IFF TRANS			
TOTAL COST	601.	4900.	5501.
MA100 IFF INT			
TOTAL COST	1250.	11283.	12533.
MA100 IFF CRYP			
TOTAL COST	239.	1723.	1962.
MA100 INT TEST DUMMY			
TOTAL COST	0.	0.	0.

Architecture Two

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
MA200 DEDICATED JTIDS IFF TACAN 1 OF 3			
TOTAL COST	11832.	15385.	27217.
MA200 DEDICATED JTIDS IFF TACAN 2 OF 3			
TOTAL COST	10398.	13146.	23544.
MA200 DEDICATED JTIDS IFF TACAN 3 OF 3			
TOTAL COST	10398.	13146.	23544.

Architecture Seven

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
MA700 RF MOD4 VAR FREQ IF			
TOTAL COST	303.	15505.	15808.
MA700 RF MOD5 70 MHZ IF			
TOTAL COST	296.	14650.	14947.
MA700 RF MOD11 SHOP SYNTH			
TOTAL COST	1193.	15211.	16404.
MA700 RF MOD14 L TRAN			
TOTAL COST	1200.	6912.	8113.
MA700 RF MOD18 MULTI BA EX			
TOTAL COST	481.	4852.	5332.
MA700 INT TEST			
TOTAL COST	860.	8381.	9241.

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
MA700 RF MOD8 L DUALT PREAMP			
TOTAL COST	229.	2521.	2749.
MA700 RF MOD12 ANT SEL			
TOTAL COST	210.	2137.	2347.
MA700 INT TEST			
TOTAL COST	109.	580.	690.

Antennas

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
MA100 GPS ANT1			
TOTAL COST	21.	210.	231.
MA100 GPS ANT2			
TOTAL COST	15.	163.	178.
MA100 JTIDS ARRAY ANT			
TOTAL COST	42.	478.	520.
MA100 JTIDS TACAN BLADE ANT			
TOTAL COST	0.	138.	138.
MA100 SEEKTALK ANT			
TOTAL COST	96.	1233.	1329.
MA100 UHF ANT			
TOTAL COST	0.	303.	303.
MA100 VHF ANT1			
TOTAL COST	61.	493.	554.
MA100 VHF ANT2			
TOTAL COST	68.	609.	677.

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
MA100 HF ANT			
TOTAL COST	622.	9224.	9845.

APPENDIX F

ACQUISITION COST DETAIL DATA

APPENDIX F

ACQUISITION COST DETAIL DATA

Development and production cost input and output data obtained from PRICE 83B are presented in this Appendix. See Section 4.2 for associated discussion. All costs are $1000.

Architecture One – MA100 in the unit title identifies Architecture One.

Architecture Two – MA200 in the unit title identifies Architecture Two. These units replace some of those in Architecture One; see Section 3 for specific identification.

Architecture Three – MA300 in the unit title identifies Architecture Three.

Architecture Four – MA400 in the unit title identifies Architecture Four units. These units along with some from other architectures are used for a complete Architecture Four; see Section 3 for specific identification.

Architecture Five – There are currently no PRICE files specifically for this architecture. Cost estimates for it are obtained by extrapolations from other architectures; see Section 3.

Architecture Six – MA600 in the unit title identifies Architecture Six units. These units along with some from other architectures are used for a complete Architecture Six; see Section 3 for specific identification.

Architecture Seven – MA700 in the unit title identifies Architecture Seven units. These units along with some from other architectures are used for a complete Architecture Seven; see Section 3 for specific identification.

Antennas – These same antennas are also to be used for most other architectures; see Section 3 for specific identification.

ARCHITECTURE ONE

```
MA100 GPS

INPUT DATA                                     PRICE  83B  5-OCT-78   13:08
QTY       1000. PROTOS   10.0 WT       60.000 VOL        0.680 MODE      1.
QTYSYS       1. INTEGE  0.010 INTEGS    0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      25.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE  7.974 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR    150.000 CMPNTS   420. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    84.0 ENMTHP   24.0 ENMTHT    32.0 ECMPLX    2.500 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHF    0.0 LCURVE  0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS     1.00

PROGRAM COST               DEVELOPMENT        PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                        1726.               53.            1779.
 DESIGN                          7700.              149.            7849.
 SYSTEMS                         2697.                0.            2697.
 PROJ MGMT                       2641.             1123.            3764.
 DATA                            1196.               53.            1250.
  SUBTOTAL(ENG)                 15960.             1379.           17339.

MANUFACTURING
 PRODUCTION                         0.            21211.           21211.
 PROTOTYPE                       1561.                0.            1561.
 TOOL-TEST EQ                     208.              726.             934.
  SUBTOTAL(MFG)                  1769.            21937.           23706.

  TOTAL COST                    17729.            23316.           41045.

AVCOST               21.21            TOTAL AV PROD COST            23.32
WT      60.000 VOL        0.680 ECNS     0.030 NEWST    1.000 DESRPS 0.202
LCURVE   0.878                  ECNE     0.111 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS      25.000 WSCF     36.743 MECID    0.000 PRODS  3.865 MCPLXS  5.520
ELECTRONICS
WE      35.000 WECF     60.518 CMPID    0.000 PRODE  4.136 MCPLXE  7.974
PWR    150.000 CMPNTS    420.                 PWRFAC 0.249 CMPEFF-17.490

SCHEDULES
ENMTHS  84.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF      0.167
PRMTHS 116.000 PRMTHF 147.834 AVER. PROD RATE PER MONTH          31.412

COST RANGES                DEVELOPMENT        PRODUCTION       TOTAL COST
      FROM                      15035.            18117.           33152.
      CENTER                    17729.            23316.           41045.
      TO                        21870.            31919.           53789.
```

```
MA100 JTIDS 1 OF 3

INPUT DATA                                 PRICE  83B  5-OCT-78   13:09
QTY      1000. PROTOS   10.0 WT      50.000 VOL       0.463 MODE      1.
QTYSYS      1. INTEGE  0.010 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS     38.000 MCPLXS  5.520 PRODS   0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.700 MCPLXE  8.200 PRODE   0.000 NEWEL     1.000 DESRPE   0.000
PWR   117.000 CMPNTS   433. CMPID   0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   84.0 ENMTHP   24.0 ENMTHT   32.0 ECMPLX    2.500 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHP    0.0 LCURVE  0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST             DEVELOPMENT       PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        990.              31.             1021.
 DESIGN                         4452.              98.             4549.
 SYSTEMS                        1522.               0.             1522.
 PROJ MGMT                      1486.             607.             2094.
 DATA                            669.              29.              698.
  SUBTOTAL(ENG)                 9118.             765.             9883.

MANUFACTURING
 PRODUCTION                        0.           11553.            11553.
 PROTOTYPE                       894.               0.              894.
 TOOL-TEST EQ                    126.             398.              524.
  SUBTOTAL(MFG)                 1020.           11951.            12971.

  TOTAL COST                   10138.           12716.            22854.

AVCOST              11.55            TOTAL AV PROD COST            12.72
WT     50.000 VOL         0.463 ECNS    0.031 NEWST   1.000 DESRPS 0.175
LCURVE  0.878                   ECNE    0.122 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS      38.000 WSCF     82.073 MECID    0.000 PRODS  3.668 MCPLXS  5.520
ELECTRONICS
WE      12.000 WECF     37.026 CMPID    0.000 PRODE  4.601 MCPLXE  8.200
PWR    117.000 CMPNTS    433.                 PWRFAC 0.300 CMPEFF -0.727

SCHEDULES
ENMTHS  84.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF     0.162
PRMTHS 116.000 PRMTHP 148.999 AVER. PROD RATE PER MONTH          30.304

COST RANGES              DEVELOPMENT       PRODUCTION        TOTAL COST
     FROM                       8706.           10148.            18855.
     CENTER                    10138.           12716.            22854.
     TO                        12209.           16543.            28752.
```

```
MA100 JTIDS 2 OF 3

INPUT DATA                                  PRICE  83B  5-OCT-78   13:11
QTY      1000. PROTOS   10.0 WT      50.000 VOL       0.463 MODE       1.
QTYSYS      1. INTEGE  0.010 INTEGS   0.010 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS     38.000 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.700 MCPLXE   8.200 PRODE    0.000 NEWEL     1.000 DESRPE    0.000
PWR   117.000 CMPNTS    433. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   84.0 ENMTHP    24.0 ENMTHT    32.0 ECMPLX    2.500 PRNF      0.000

PRODUCTION
PRMTHS  116.0 PRMTHF     0.0 LCURVE   0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT        PRODUCTION         TOTAL COST
ENGINEERING
 DRAFTING                      990.                31.              1021.
 DESIGN                       4452.                98.              4549.
 SYSTEMS                      1522.                 0.              1522.
 PROJ MGMT                    1486.               607.              2094.
 DATA                          669.                29.               698.
  SUBTOTAL(ENG)               9118.               765.              9883.

MANUFACTURING
 PRODUCTION                      0.             11553.             11553.
 PROTOTYPE                     894.                 0.               894.
 TOOL-TEST EQ                  126.               398.               524.
  SUBTOTAL(MFG)               1020.             11951.             12971.

  TOTAL COST                 10138.             12716.             22854.

AVCOST               11.55          TOTAL AV PROD COST              12.72
WT      50.000 VOL         0.463 ECNS     0.031 NEWST    1.000 DESRPS 0.175
LCURVE  0.878                    ECNE     0.122 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS      38.000 WSCF     82.073 MECID    0.000 PRODS   3.666 MCPLXS   5.520
ELECTRONICS
WE      12.000 WECF     37.026 CMPID    0.000 PRODE   4.601 MCPLXE   8.200
PWR    117.000 CMPNTS    433.                 PWRFAC 0.300 CMPEFF  -0.727

SCHEDULES
ENMTHS  84.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF       0.162
PRMTHS 116.000 PRMTHF 148.999 AVER. PROD RATE PER MONTH            30.304

COST RANGES             DEVELOPMENT        PRODUCTION         TOTAL COST
     FROM                     8706.             10148.             18855.
     CENTER                  10138.             12716.             22854.
     TO                      12209.             16543.             28752.
```

```
MA100 JTIDS 3 OF 3

INPUT DATA                                    PRICE  838  5-OCT-78   13:13
QTY       1000. PROTOS    10.0 WT      50.000 VOL       0.463 MODE       1.
QTYSYS       1. INTEGE   0.010 INTEGS   0.010 AMULTD  150.00% AMULTP 150.00%

MECH/STRUCT
WS      38.000 MCPLXS    5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.700 MCPLXE    8.200 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR    117.000 CMPNTS     433. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    84.0 ENMTHP     24.0 ENMTHT    32.0 ECMPLX    2.500 PRNF     0.000

PRODUCTION
PRMTHS   116.0 PRMTHF      0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC       0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM    1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	990.	31.	1021.
DESIGN	4452.	98.	4549.
SYSTEMS	1522.	0.	1522.
PROJ MGMT	1486.	607.	2094.
DATA	669.	29.	698.
SUBTOTAL(ENG)	9118.	765.	9883.
MANUFACTURING			
PRODUCTION	0.	11553.	11553.
PROTOTYPE	894.	0.	894.
TOOL-TEST EQ	126.	398.	524.
SUBTOTAL(MFG)	1020.	11951.	12971.
TOTAL COST	10138.	12716.	22854.

```
AVCOST                11.55           TOTAL AV PROD COST              12.72
WT       50.000 VOL         0.463 ECNS     0.031 NEWST    1.000 DESRPS 0.175
LCURVE    0.878                 ECNE     0.122 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS       38.000 WSCF       82.073 MECID    0.000 PRODS    3.666 MCPLXS  5.520
ELECTRONICS
WE       12.000 WECF       37.026 CMPID    0.000 PRODE    4.601 MCPLXE  8.200
PWR     117.000 CMPNTS       433.                PWRFAC   0.300 CMPEFF -0.727

SCHEDULES
ENMTHS  84.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF         0.162
PRMTHS 116.000 PRMTHF 148.999 AVER. PROD RATE PER MONTH              30.304
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	8706.	10148.	18855.
CENTER	10138.	12716.	22854.
TO	12209.	16543.	28752.

```
MA100 SEEKTALK

INPUT DATA                                  PRICE  83B  5-OCT-78   13:15
QTY     1000. PROTOS   10.0 WT      27.000 VOL      0.521 MODE      1.
QTYSYS     1. INTEGE  0.010 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS    12.000 MCPLXS  5.520 PRODS   0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.700 MCPLXE  8.136 PRODE   0.000 NEWEL    1.000 DESRPE   0.000
PWR    30.000 CMPNTS   500. CMPID   0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   84.0 ENMTHP   24.0 ENMTHT   32.0 ECMPLX   2.500 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHF    0.0 LCURVE  0.878 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS   1.00.

PROGRAM COST            DEVELOPMENT      PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                     1044.             34.            1077.
 DESIGN                       4684.            102.            4786.
 SYSTEMS                      1612.              0.            1612.
 PROJ MGMT                    1561.            616.            2177.
 DATA                          707.             29.             736.
  SUBTOTAL(ENG)               9607.            781.           10388.

MANUFACTURING
 PRODUCTION                      0.          11732.           11732.
 PROTOTYPE                     848.              0.             848.
 TOOL-TEST EQ                  116.            403.             519.
  SUBTOTAL(MFG)                964.          12135.           13099.

  TOTAL COST                 10571.          12917.           23487.

AVCOST              11.73          TOTAL AV PROD COST          12.92
WT     27.000 VOL        0.521 ECNS    0.030 NEWST   1.000 DESRPS 0.149
LCURVE  0.878                  ECNE    0.118 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS      12.000 WSCF    23.041 MECID   0.000 PRODS  3.984 MCPLXS  5.520
ELECTRONICS
WE      15.000 WECF    41.145 CMPID   0.000 PRODE  4.469 MCPLXE  8.136
PWR     30.000 CMPNTS    500.               PWRFAC 0.823 CMPEFF-21.825

SCHEDULES
ENMTHS  84.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF    0.163
PRMTHS 116.000 PRMTHF 146.236 AVER. PROD RATE PER MONTH         31.021

COST RANGES             DEVELOPMENT      PRODUCTION       TOTAL COST
     FROM                     9072.          10264.           19335.
     CENTER                  10571.          12917.           23487.
     TO                      12727.          16846.           29573.
```

```
MA100 UHFAM RT

INPUT DATA                                    PRICE  836   5-OCT-78    13:17
QTY      1000. PROTOS    10.0 WT        6.000 VOL        0.139 MODE       1.
QTYSYS      1. INTEGE   0.010 INTEGS    0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       3.000 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.900 MCPLXE   8.125 PRODE     0.000 NEWEL      1.000 DESRPE   0.000
PWR     18.000 CMPNTS    250. CMPID     0.000 PWRFAC     0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    98.0 ENMTHP    12.0 ENMTHT     18.0 ECMPLX     0.500 PRNF     0.000

PRODUCTION
PRMTHS   116.0 PRMTHP     0.0 LCURVE    0.878 ECNE       0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT    1.000 DATA       1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ     1.000 PDATA      1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT        PRODUCTION         TOTAL COST
ENGINEERING
 DRAFTING                       66.               10.                77.
 DESIGN                        166.               33.               199.
 SYSTEMS                         6.                0.                 6.
 PROJ MGMT                      35.              150.               185.
 DATA                           11.                7.                18.
  SUBTOTAL(ENG)                284.              200.               485.

MANUFACTURING
 PRODUCTION                      0.             2805.              2805.
 PROTOTYPE                     113.                0.               113.
 TOOL-TEST EQ                    6.              112.               118.
  SUBTOTAL(MFG)                119.             2917.              3037.

  TOTAL COST                   404.             3118.              3521.

AVCOST               2.81       TOTAL AV PROD COST              3.12
WT       6.000 VOL       0.139 ECNS     0.028 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                 ECNE     0.110 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS        3.000 WSCF     21.614 MECID    0.000 PRODS   4.000 MCPLXS   5.520
ELECTRONICS
WE        3.000 WECF     24.015 CMPID    0.000 PRODE   4.886 MCPLXE   8.125
PWR      18.000 CMPNTS    250.                 PWRFAC 0.729 CMPEFF -1.279

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF     0.123
PRMTHS 116.000 PRMTHP 147.091 AVER. PROD RATE PER MONTH          32.164

COST RANGES             DEVELOPMENT        PRODUCTION         TOTAL COST
      FROM                     342.             2547.              2889.
      CENTER                   404.             3118.              3521.
      TO                       489.             3677.              4365.
```

```
MA100 VHFAM RT

INPUT DATA                                 PRICE  83B  5-OCT-78   13:16
QTY      1000. PROTOS    10.0 WT       7.000 VOL       0.156 MODE      1.
QTYSYS      1. INTEGE   0.010 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       3.000 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.700 MCPLXE   8.115 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR     16.000 CMPNTS    260. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    96.0 ENMTHP    12.0 ENMTHT    16.0 ECMPLX    0.500 PRNF     0.000

PRODUCTION
PRMTHS   116.0 PRMTHP     0.0 LCURVE   0.876 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT         PRODUCTION          TOTAL COST
ENGINEERING
 DRAFTING                         80.                12.                 92.
 DESIGN                          199.                38.                237.
 SYSTEMS                           7.                 0.                  7.
 PROJ MGMT                        42.               190.                232.
 DATA                             14.                 9.                 23.
  SUBTOTAL(ENG)                  342.               249.                591.

MANUFACTURING
 PRODUCTION                        0.              3510.               3510.
 PROTOTYPE                       141.                 0.                141.
 TOOL-TEST EQ                      8.               145.                153.
  SUBTOTAL(MFG)                  149.              3655.               3804.

  TOTAL COST                     492.              3904.               4396.

AVCOST                3.51             TOTAL AV PROD COST               3.90
WT       7.000 VOL         0.156 ECNS     0.026 NEWST    1.000 DESRPS 0.000
LCURVE   0.876                   ECNE     0.110 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS         3.000 WSCF     19.194 MECID    0.000 PRODS  4.031 MCPLXS   5.520
ELECTRONICS
WE         4.000 WECF     36.560 CMPID    0.000 PRODE  4.563 MCPLXE   8.115
PWR       16.000 CMPNTS     260.                PWRFAC 0.748 CMPEFF  -6.642

SCHEDULES
ENMTHS    96.000 ENMTHP   12.000 ENMTHT 16.000 ECMPLX 0.500 PRNF      0.123
PRMTHS   116.000 PRMTHP  147.139 AVER. PROD RATE PER MONTH           32.114

COST RANGES               DEVELOPMENT         PRODUCTION          TOTAL COST
     FROM                        412.              3135.               3547.
     CENTER                      492.              3904.               4396.
     TO                          607.              5015.               5622.
```

MA100 VHFFM RT

```
INPUT DATA                                PRICE  83B  5-OCT-78   13:20
QTY      1000. PROTOS    10.0 WT         5.000 VOL       0.104 MODE       1.
QTYSYS      1. INTEGE   0.010 INTEGS     0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       2.000 MCPLXS   5.520 PRODS      0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.700 MCPLXE   8.116 PRODE      0.000 NEWEL     1.000 DESRPE   0.000
PWR     10.000 CMPNTS    220. CMPID      0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    98.0 ENMTHP    12.0 ENMTHT     18.0 ECMPLX     0.500 PRNF     0.000

PRODUCTION
PRMTHS   116.0 PRMTHP     0.0 LCURVE     0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT     1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ      1.000 PDATA     1.000 PTLGTS   1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	65.	10.	75.
DESIGN	163.	30.	193.
SYSTEMS	6.	0.	6.
PROJ MGMT	34.	148.	182.
DATA	11.	7.	18.
SUBTOTAL(ENG)	279.	195.	474.
MANUFACTURING			
PRODUCTION	0.	2716.	2716.
PROTOTYPE	109.	0.	109.
TOOL-TEST EQ	6.	122.	129.
SUBTOTAL(MFG)	115.	2839.	2954.
TOTAL COST	394.	3034.	3428.

```
AVCOST                  2.72          TOTAL AV PROD COST           3.03
WT       5.000 VOL          0.104 ECNS    0.028 NEWST   1.000 DESRPS 0.000
LCURVE   0.878                    ECNE    0.110 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS       2.000 WSCF    19.194 MECID   0.000 PRODS  4.031 MCPLXS   5.520
ELECTRONICS
WE       3.000 WECF    41.130 CMPID   0.000 PRODE  4.478 MCPLXE   8.116
PWR     10.000 CMPNTS    220.                PWRFAC 0.992 CMPEFF  -9.829

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF     0.123
PRMTHS 116.000 PRMTHP 146.931 AVER. PROD RATE PER MONTH          32.330
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	329.	2427.	2757.
CENTER	394.	3034.	3428.
TO	469.	3930.	4419.

```
MA100 HF RT

INPUT DATA                                  PRICE  83B  5-OCT-78   13:22
QTY      1000. PROTOS   10.0 WT      12.000 VOL       0.231 MODE      1.
QTYSYS      1. INTEGE  0.010 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      6.000 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.700 MCPLXE   8.094 PRODE    0.000 NEWEL     1.000 DESRPE    0.000
PWR    80.000 CMPNTS    300. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   96.0 ENMTHP    12.0 ENMTHT    18.0 ECMPLX    0.500 PRNF      0.000

PRODUCTION
PRMTHS  116.0 PRMTHP     0.0 LCURVE   0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS     1.00

PROGRAM COST            DEVELOPMENT       PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                      106.              16.              122.
 DESIGN                        265.              50.              314.
 SYSTEMS                         9.               0.                9.
 PROJ MGMT                      57.             270.              327.
 DATA                           19.              13.               31.
  SUBTOTAL(ENG)                457.             348.              805.

MANUFACTURING
 PRODUCTION                      0.            5000.             5000.
 PROTOTYPE                     203.               0.              203.
 TOOL-TEST EQ                   11.             193.              204.
  SUBTOTAL(MFG)                215.            5193.             5407.

  TOTAL COST                   671.            5541.             6212.

AVCOST                  5.00          TOTAL AV PROD COST            5.54
WT      12.000 VOL        0.231 ECNS    0.029 NEWST    1.000 DESRPS 0.028
LCURVE  0.878                 ECNE    0.110 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS        6.000 WSCF     25.918 MECID    0.000 PRODS  3.953 MCPLXS   5.520
ELECTRONICS
WE        6.000 WECF     37.026 CMPID    0.000 PRODE  4.542 MCPLXE   8.094
PWR      80.000 CMPNTS    300.                 PWRFAC 0.303 CMPEFF   6.123

SCHEDULES
ENMTHS  96.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF      0.123
PRMTHS 116.000 PRMTHP 147.365 AVERG PROD RATE PER MONTH          31.883

COST RANGES             DEVELOPMENT       PRODUCTION        TOTAL COST
     FROM                      561.            4440.             5000.
     CENTER                    671.            5541.             6212.
     TO                        831.            7148.             7979.
```

```
MA100 TACAN

INPUT DATA                                          PRICE  836  5-OCT-78    13:24
QTY        1000. PROTOS    10.0 WT       11.000 VOL        0.122 MODE        1.
QTYSYS        1. INTEGE   0.010 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        5.000 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.700 MCPLXE   8.084 PRODE     0.000 NEWEL      1.000 DESRPE    2.000
PWR     40.000 CMPNTS    200. CMPID     0.000 PWRFAC     0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   98.0 ENMTHP    12.0 ENMTHT    18.0 ECMPLX     0.500 PRNF      0.000

PRODUCTION
PRMTHS  116.0 PRMTHP     0.0 LCURVE   0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA       1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                         83.                12.               95.
 DESIGN                          207.                34.              241.
 SYSTEMS                           7.                 0.                7.
 PROJ MGMT                        48.               269.              317.
 DATA                             15.                13.               28.
  SUBTOTAL(ENG)                  360.               329.              689.

MANUFACTURING
 PRODUCTION                        0.              4900.             4900.
 PROTOTYPE                       199.                 0.              199.
 TOOL-TEST EQ                     11.               215.              226.
  SUBTOTAL(MFG)                  210.              5115.             5325.

  TOTAL COST                     570.              5443.             6013.

AVCOST                4.90            TOTAL AV PROD COST                5.44
WT       11.000 VOL         0.122 ECNS    0.029 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                   ECNE    0.109 NEWEL    1.000 DESRPE 0.229

MECH/STRUCT
WS        5.000 WSCF     41.152 MECID    0.000 PRODS   3.836 MCPLXS   5.520
ELECTRONICS
WE        6.000 WECF     70.547 CMPID    0.000 PRODE   4.091 MCPLXE   8.084
PWR      40.000 CMPNTS    200.                 PWRFAC 0.367 CMPEFF  -5.621

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF      0.124
PRMTHS 116.000 PRMTHP 147.255 AVER. PROD RATE PER MONTH           31.995

COST RANGES               DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                        466.              4239.             4704.
     CENTER                      570.              5443.             6013.
     TO                          739.              7467.             8206.
```

MA100 ILS VOR

INPUT DATA					PRICE 83B	5-OCT-78	13:26		
QTY	1000.	PROTOS	10.0	WT	5.000	VOL	0.104	MODE	1.
QTYSYS	1.	INTEGE	0.010	INTEGS	0.010	AMULTD	150.00%	AMULTP	150.00%
MECH/STRUCT									
WS	2.000	MCPLXS	5.520	PRODS	0.000	NEWST	1.000	DESRPS	2.000
ELECTRONICS									
USEVOL	0.850	MCPLXE	8.007	PRODE	0.000	NEWEL	1.000	DESRPE	0.000
PWR	8.000	CMPNTS	200.	CMPID	0.000	PWRFAC	0.000	CMPEFF	0.000
ENGINEERING									
ENMTHS	98.0	ENMTHP	12.0	ENMTHT	18.0	ECMPLX	0.500	PRNF	0.000
PRODUCTION									
PRMTHS	116.0	PRMTHF	0.0	LCURVE	0.878	ECNE	0.000	ECNS	0.000
GLOBAL									
YEAR	1978.	ESC	0.00%	PROJCT	1.000	DATA	1.000	TLGTST	1.000
PLTFM	1.800	SYSTEM	1.000	PPROJ	1.000	PDATA	1.000	PTLGTS	1.00

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	63.	9.	72.
DESIGN	156.	28.	183.
SYSTEMS	6.	0.	6.
PROJ MGMT	33.	134.	166.
DATA	11.	6.	17.
SUBTOTAL(ENG)	267.	177.	444.
MANUFACTURING			
PRODUCTION	0.	2481.	2481.
PROTOTYPE	101.	0.	101.
TOOL-TEST EQ	6.	109.	115.
SUBTOTAL(MFG)	107.	2590.	2697.
TOTAL COST	374.	2767.	3141.

AVCOST			2.48	TOTAL AV PROD COST					2.77
WT	5.000	VOL	0.104	ECNS	0.028	NEWST	1.000	DESRPS	0.000
LCURVE	0.878			ECNE	0.104	NEWEL	1.000	DESRPE	0.000
MECH/STRUCT									
WS	2.000	WSCF	19.194	MECID	0.000	PRODS	4.031	MCPLXS	5.520
ELECTRONICS									
WE	3.000	WECF	33.872	CMPID	0.000	PRODE	4.557	MCPLXE	8.007
PWR	8.000	CMPNTS	200.			PWRFAC	1.080	CMPEFF	-12.785
SCHEDULES									
ENMTHS	98.000	ENMTHP	12.000	ENMTHT	18.000	ECMPLX	0.500	PRNF	0.125
PRMTHS	116.000	PRMTHF	146.328	AVER. PROD RATE PER MONTH					32.973

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	314.	2230.	2544.
CENTER	374.	2767.	3141.
TO	461.	3541.	4002.

```
MA100 COM CRVP

INPUT DATA                                    PRICE  83B  5-OCT-78    13:28
QTY       1000. PROTOS    10.0 WT        5.000 VOL        0.046 MODE        1.
QTYSYS       1. INTEGE   0.010 INTEGS    0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       3.000 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.900 MCPLXE   8.032 PRODE     0.000 NEWEL      1.000 DESRPE    0.000
PWR      3.000 CMPNTS    114. CMPID     0.000 PWRFAC     0.000 CMPEFF    0.000

ENGINEERING
ENMTHS    98.0 ENMTHP    12.0 ENMTHT    18.0 ECMPLX     0.500 PRNF      0.000

PRODUCTION
PRMTHS   116.0 PRMTHP     0.0 LCURVE   0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA       1.000 TLGTST    1.000
PLTPM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST           DEVELOPMENT         PRODUCTION         TOTAL COST
ENGINEERING
 DRAFTING                      50.                 7.                57.
 DESIGN                       125.                21.               145.
 SYSTEMS                        4.                 0.                 4.
 PROJ MGMT                     26.               104.               130.
 DATA                           8.                 5.                13.
  SUBTOTAL(ENG)               214.               137.               351.

MANUFACTURING
 PRODUCTION                     0.              1898.              1898.
 PROTOTYPE                     78.                 0.                78.
 TOOL-TEST EQ                   4.                98.               102.
  SUBTOTAL(MFG)                82.              1995.              2078.

  TOTAL COST                  296.              2132.              2429.

AVCOST                 1.90         TOTAL AV PROD COST               2.13
WT       5.000 VOL          0.046 ECNS    0.028 NEWST   1.000 DESRPS 0.000
LCURVE   0.878                    ECNE    0.105 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS       3.000 WSCF     64.795 MECID    0.000 PRODS   3.725 MCPLXS   5.520
ELECTRONICS
WE       2.000 WECF     47.996 CMPID    0.000 PRODE   4.323 MCPLXE   8.032
PWR      3.000 CMPNTS    114.                 PWRFAC  1.430 CMPEFF-21.551

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF       0.125
PRMTHS 116.000 PRMTHP 146.450 AVERL PROD RATE PER MONTH            32.841

COST RANGES            DEVELOPMENT         PRODUCTION         TOTAL COST
     FROM                     247.              1698.              1945.
     CENTER                   296.              2132.              2429.
     TO                       373.              2813.              3185.
```

```
MA100 IFF TRANS

INPUT DATA                                  PRICE  83B  5-OCT-78   13:30
QTY      1000. PROTOS    10.0 WT       12.000 VOL        0.156 MODE      1.
QTYSYS      1. INTEGE   0.010 INTEGS    0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       7.000 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.700 MCPLXE   8.102 PRODE     0.000 NEWEL      1.000 DESRPE    0.000
PWR    40.000 CMPNTS    240. CMPID     0.000 PWRFAC     0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   98.0 ENMTHP    12.0 ENMTHT    18.0 ECMPLX     0.500 PRNF      0.000

PRODUCTION
PRMTHS  116.0 PRMTHP     0.0 LCURVE   0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA       1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST            DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                       96.               14.              110.
 DESIGN                        239.               43.              281.
 SYSTEMS                         9.                0.                9.
 PROJ MGMT                      52.              240.              292.
 DATA                           17.               11.               28.
  SUBTOTAL(ENG)                411.              309.              720.

MANUFACTURING
 PRODUCTION                      0.             4412.             4412.
 PROTOTYPE                     180.                0.              180.
 TOOL-TEST EQ                   10.              179.              190.
  SUBTOTAL(MFG)                190.             4591.             4781.

  TOTAL COST                   601.             4900.             5501.

AVCOST              4.41           TOTAL AV PROD COST              4.90
WT      12.000 VOL        0.156 ECNS     0.029 NEWST   1.000 DESRPS 0.000
LCURVE  0.878                   ECNE     0.110 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS       7.000 WSCF     44.786 MECID    0.000 PRODS  3.815 MCPLXS  5.520
ELECTRONICS
WE       5.000 WECF     45.700 CMPID    0.000 PRODE  4.395 MCPLXE  8.102
PWR     40.000 CMPNTS    240.                 PWRFAC 0.415 CMPEFF -0.939

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF      0.123
PRMTHS 116.000 PRMTHP 147.403 AVER. PROD RATE PER MONTH          31.844

COST RANGES             DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                      500.             3896.             4396.
     CENTER                    601.             4900.             5501.
     TO                        754.             6438.             7192.
```

```
MA100 IFF INT

INPUT DATA                                  PRICE  836  5-OCT-78   13:31
QTY      1000. PROTOS   10.0 WT      22.000 VOL       0.260 MODE       1.
QTYSYS      1. INTEGE  0.010 INTEGS   0.100 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       8.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.700 MCPLXE  8.098 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR   120.000 CMPNTS   280. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   98.0 ENMTHP   12.0 ENMTHT   18.0 ECMPLX    0.500 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHP    0.0 LCURVE  0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                      189.               29.             218.
 DESIGN                        470.               81.             551.
 SYSTEMS                        17.                0.              17.
 PROJ MGMT                     106.              563.             668.
 DATA                           34.               27.              61.
  SUBTOTAL(ENG)                815.              700.            1515.

MANUFACTURING
 PRODUCTION                      0.            10174.           10174.
 PROTOTYPE                     412.                0.             412.
 TOOL-TEST EQ                   23.              410.             433.
  SUBTOTAL(MFG)                435.            10583.           11019.

  TOTAL COST                  1250.            11283.           12533.

AVCOST               10.17         TOTAL AV PROD COST             11.28
WT      22.000 VOL        0.260 ECNS     0.029 NEWST    1.000 DESRPS 0.054
LCURVE  0.878                   ECNE     0.111 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS       8.000 WSCF    30.722 MECID    0.000 PRODS   3.910 MCPLXS  5.520
ELECTRONICS
WE      14.000 WECF    76.805 CMPID    0.000 PRODE   4.043 MCPLXE  8.098
PWR    120.000 CMPNTS    280.                PWRFAC  0.221 CMPEFF -5.704

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF     0.123
PRMTHS 116.000 PRMTHP 147.795 AVER. PROD RATE PER MONTH          31.451

COST RANGES             DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                     1021.             8712.            9733.
     CENTER                   1250.            11283.           12533.
     TO                       1622.            15681.           17304.
```

```
MA100 IFF CRYP

INPUT DATA                                  PRICE  836  5-OCT-78   13:33
QTY      1000. PROTOS   10.0 WT      3.000 VOL      0.083 MODE      1.
QTYSYS      1. INTEGE  0.010 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.500 MCPLXS  5.520 PRODS   0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.900 MCPLXE  8.117 PRODE   0.000 NEWEL    1.000 DESRPE   0.000
PWR      2.000 CMPNTS    65. CMPID   0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    98.0 ENMTHP   12.0 ENMTHT   18.0 ECMPLX   0.500 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHP     0.0 LCURVE  0.878 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS    1.00

PROGRAM COST          DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                     41.                6.               47.
 DESIGN                      102.               21.              123.
 SYSTEMS                       4.                0.                4.
 PROJ MGMT                    21.               82.              103.
 DATA                          7.                4.               11.
  SUBTOTAL(ENG)              175.              113.              287.

MANUFACTURING
 PRODUCTION                    0.             1525.             1525.
 PROTOTYPE                    61.                0.               61.
 TOOL-TEST EQ                  3.               86.               89.
  SUBTOTAL(MFG)               65.             1610.             1675.

  TOTAL COST                 239.             1723.             1962.

AVCOST              1.52          TOTAL AV PROD COST            1.72
WT       3.000 VOL      0.083 ECNS    0.028 NEWST   1.000 DESRPS 0.000
LCURVE  0.878                 ECNE    0.109 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS        1.500 WSCF    18.007 MECID   0.000 PRODS  4.046 MCPLXS  5.520
ELECTRONICS
WE        1.500 WECF    20.008 CMPID   0.000 PRODE  5.026 MCPLXE  8.117
PWR       2.000 CMPNTS     65.                PWRFAC 1.288 CMPEFF-25.370

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.500 PRNF     0.123
PRMTHS 116.000 PRMTHP 146.606 AVER. PROD RATE PER MONTH          32.673

COST RANGES           DEVELOPMENT        PRODUCTION        TOTAL COST
      FROM                   204.             1421.             1624.
      CENTER                 239.             1723.             1962.
      TO                     287.             2112.             2399.
```

ARCHITECTURE TWO

```
MA200 DEDICATED JTIDS IFF TACAN 1 OF 3

INPUT DATA                                PRICE  83B 19-OCT-78    12:43
QTY       1000. PROTOS    10.0 WT      60.000 VOL       0.716 MODE       1.
QTYSYS       1. INTEGE   0.010 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      45.000 MCPLXS   5.520 PRODS   0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.700 MCPLXE   8.209 PRODE   0.000 NEWEL    1.000 DESRPE   0.000
PWR   169.000 CMPNTS    625. CMPID   0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   84.0 ENMTHP   24.0 ENMTHT   32.0 ECMPLX   2.500 PRNF    ,0.000

PRODUCTION
PRMTHS  116.0 PRMTHP    0.0 LCURVE  0.878 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        1150.                37.              1187.
 DESIGN                          5174.               119.              5294.
 SYSTEMS                         1766.                 0.              1766.
 PROJ MGMT                       1732.               731.              2462.
 DATA                             778.                35.               812.
  SUBTOTAL(ENG)                 10600.               922.             11522.

MANUFACTURING
 PRODUCTION                         0.             14009.             14009.
 PROTOTYPE                       1082.                 0.              1082.
 TOOL-TEST EQ                     151.               454.               605.
  SUBTOTAL(MFG)                  1232.             14463.             15695.

  TOTAL COST                    11832.             15385.             27217.

AVCOST               14.01            TOTAL AV PROD COST             15.38
WT      60.000 VOL          0.716 ECNS     0.031 NEWST    1.000 DESRPS 0.226
LCURVE  0.878                     ECNE     0.123 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS       45.000 WSCF     62.849 MECID    0.000 PRODS  3.732 MCPLXS   5.520
ELECTRONICS
WE       15.000 WECF     29.928 CMPID    0.000 PRODE  4.766 MCPLXE   8.209
PWR     169.000 CMPNTS     625.                PWRFAC 0.300 CMPEFF   2.070

SCHEDULES
ENMTHS  84.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF     0.162
PRMTHS 116.000 PRMTHP 149.180 AVER. PROD RATE PER MONTH          30.139

COST RANGES               DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                       10206.             12369.             22575.
     CENTER                     11832.             15385.             27217.
     TO                         14122.             19683.             33805.
```

MA200 DEDICATED JTIDS IFF TACAN 2 OF 3

```
INPUT DATA                               PRICE  83B 19-OCT-78   12:45
QTY      1000. PROTOS   10.0 WT      50.000 VOL       0.597 MODE      1.
QTYSYS      1. INTEGE  0.010 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS     37.500 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.700 MCPLXE   8.209 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR   141.000 CMPNTS    520. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   84.0 ENMTHP    24.0 ENMTHT    32.0 ECMPLX    2.500 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHP     0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	1015.	32.	1047.
DESIGN	4566.	105.	4671.
SYSTEMS	1559.	0.	1559.
PROJ MGMT	1523.	624.	2147.
DATA	685.	30.	715.
SUBTOTAL(ENG)	9349.	791.	10139.
MANUFACTURING			
PRODUCTION	0.	11961.	11961.
PROTOTYPE	921.	0.	921.
TOOL-TEST EQ	129.	395.	523.
SUBTOTAL(MFG)	1050.	12355.	13405.
TOTAL COST	10398.	13146.	23544.

```
AVCOST              11.96            TOTAL AV PROD COST            13.15
WT      50.000 VOL          0.597 ECNS     0.031 NEWST   1.000 DESRPS 0.201
LCURVE  0.878                     ECNE     0.123 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS      37.500 WSCF     62.814 MECID    0.000 PRODS   3.732 MCPLXS   5.520
ELECTRONICS
WE      12.500 WECF     29.911 CMPID    0.000 PRODE   4.766 MCPLXE   8.209
PWR    141.000 CMPNTS     520.                PWRFAC  0.300 CMPEFF   2.075

SCHEDULES
ENMTHS  84.000 ENMTHP   24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF     0.162
PRMTHS 116.000 PRMTHP  149.053 AVER. PROD RATE PER MONTH          30.254
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	8970.	10578.	19548.
CENTER	10398.	13146.	23544.
TO	12410.	16806.	29216.

MA200 DEDICATED JTIDS IFF TACAN 3 OF 3

```
INPUT DATA                                PRICE  83B 19-OCT-78    12:46
QTY       1000. PROTOS    10.0 WT       50.000 VOL        0.597 MODE       1.
QTYSYS       1. INTEGE   0.010 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      37.500 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.700 MCPLXE   8.209 PRODE    0.000 NEWEL     1.000 DESRPE    0.000
PWR    141.000 CMPNTS    520. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS    84.0 ENMTHP    24.0 ENMTHT    32.0 ECMPLX    2.500 PRNF      0.000

PRODUCTION
PRMTHS   116.0 PRMTHF     0.0 LCURVE   0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS     1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	1015.	32.	1047.
DESIGN	4566.	105.	4671.
SYSTEMS	1559.	0.	1559.
PROJ MGMT	1523.	624.	2147.
DATA	685.	30.	715.
SUBTOTAL(ENG)	9349.	791.	10139.
MANUFACTURING			
PRODUCTION	0.	11961.	11961.
PROTOTYPE	921.	0.	921.
TOOL-TEST EQ	129.	395.	523.
SUBTOTAL(MFG)	1050.	12355.	13405.
TOTAL COST	10398.	13146.	23544.

```
AVCOST              11.96           TOTAL AV PROD COST           13.15
WT      50.000 VOL         0.597 ECNS     0.031 NEWST   1.000 DESRPS 0.201
LCURVE   0.878                   ECNE     0.123 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS      37.500 WSCF     62.814 MECID    0.000 PRODS  3.732 MCPLXS   5.520
ELECTRONICS
WE      12.500 WECF     29.911 CMPID    0.000 PRODE  4.766 MCPLXE   8.209
PWR    141.000 CMPNTS     520.                PWRFAC 0.300 CMPEFF   2.075

SCHEDULES
ENMTHS  84.000 ENMTHP  24.000 ENMTHT 32.000 ECMPLX 2.500 PRNF      0.162
PRMTHS 116.000 PRMTHF 149.053 AVER. PROD RATE PER MONTH           30.254
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	8970.	10578.	19548.
CENTER	10398.	13146.	23544.
TO	12410.	16806.	29216.

ARCHITECTURE THREE

MA300 RF MOD1 DUAL GPS PREAMP

```
INPUT DATA                                      PRICE  836 23-OCT-78   18:06
QTY       5000. PROTOS    50.0 WT         1.000 VOL       0.017 MODE       1.
QTYSYS       5. INTEGE   0.800 INTEGS     0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.600 MCPLXS   5.520 PRODS      0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   8.069 PRODE      0.000 NEWEL     1.000 DESRPE   0.400
PWR      1.000 CMPNTS     60. CMPID      0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT     19.0 ECMPLX     1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE     0.854 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT     1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ      1.000 PDATA     1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	17.	2.	19.
DESIGN	54.	6.	60.
SYSTEMS	6.	0.	6.
PROJ MGMT	11.	90.	100.
DATA	3.	4.	7.
SUBTOTAL(ENG)	90.	102.	192.
MANUFACTURING			
PRODUCTION	0.	1413.	1413.
PROTOTYPE	79.	0.	79.
TOOL-TEST EQ	6.	270.	276.
SUBTOTAL(MFG)	85.	1683.	1768.
TOTAL COST	175.	1785.	1960.

```
AVCOST                 0.28           TOTAL AV PROD COST               0.36
WT       1.000 VOL          0.017 ECNS    0.036 NEWST   1.000 DESRPS 0.000
LCURVE   0.854                    ECNE    0.141 NEWEL   1.000 DESRPE 0.400

MECH/STRUCT
WS        0.600 WSCF     35.294 MECID    0.000 PRODS  3.875 MCPLXS   5.520
ELECTRONICS
WE        0.400 WECF     27.682 CMPID    0.000 PRODE  4.755 MCPLXE   8.069
PWR       1.000 CMPNTS      60.                PWRFAC 1.942 CMPEFF  -8.822

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF       0.047
PRMTHS 121.000 PRMTHP 160.532 AVER. PROD RATE PER MONTH           126.478
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	148.	1457.	1604.
CENTER	175.	1785.	1960.
TO	213.	2246.	2459.

MA300 RF MOD6 GPS LO SYNTH

```
INPUT DATA                                      PRICE  83B 23-OCT-78    16:06
QTY      1000. PROTOS    10.0 WT       1.000 VOL       0.017 MODE       1.
QTYSYS      1. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.600 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.650 MCPLXE   8.096 PRODE    0.000 NEWEL     1.000 DESRPE   0.250
PWR      6.000 CMPNTS    150. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF     0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	20.	2.	22.
DESIGN	65.	6.	70.
SYSTEMS	7.	0.	7.
PROJ MGMT	8.	28.	36.
DATA	3.	1.	4.
SUBTOTAL(ENG)	103.	37.	140.
MANUFACTURING			
PRODUCTION	0.	505.	505.
PROTOTYPE	18.	0.	18.
TOOL-TEST EQ	2.	54.	56.
SUBTOTAL(MFG)	20.	559.	579.
TOTAL COST	123.	596.	719.

```
AVCOST                 0.50             TOTAL AV PROD COST             0.60
WT       1.000 VOL          0.017 ECNS     0.028 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                    ECNE     0.106 NEWEL    1.000 DESRPE 0.250

MECH/STRUCT
WS         0.600 WSCF     34.463 MECID    0.000 PRODS   3.881 MCPLXS   5.520
ELECTRONICS
WE         0.400 WECF     27.045 CMPID    0.000 PRODE   4.777 MCPLXE   8.096
PWR        6.000 CMPNTS     150.                PWRFAC  1.080 CMPEFF  20.785

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.124
PRMTHS 121.000 PRMTHF 150.781 AVER. PROD RATE PER MONTH          33.578
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	106.	489.	595.
CENTER	123.	596.	719.
TO	148.	744.	892.

MA300 RF MOD7 L DUAL FT PREAMP

```
INPUT DATA                                    PRICE  83B 23-OCT-78   18:09
QTY      3000. PROTOS   30.0 WT       1.000 VOL       0.017 MODE      1.
QTYSYS      3. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.600 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE   8.050 PRODE    0.000 NEWEL     1.000 DESRPE   0.500
PWR     4.000 CMPNTS     60. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF     0.0 LCURVE   0.858 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS   1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	14.	1.	16.
DESIGN	46.	5.	50.
SYSTEMS	5.	0.	5.
PROJ MGMT	8.	58.	66.
DATA	3.	3.	5.
SUBTOTAL(ENG)	76.	67.	143.
MANUFACTURING			
PRODUCTION	0.	962.	962.
PROTOTYPE	48.	0.	48.
TOOL-TEST EQ	4.	164.	168.
SUBTOTAL(MFG)	52.	1126.	1178.
TOTAL COST	128.	1193.	1321.

```
AVCOST               0.32           TOTAL AV PROD COST          0.40
WT      1.000 VOL        0.017 ECNS    0.032 NEWST   1.000 DESRPS 0.000
LCURVE  0.858                  ECNE    0.125 NEWEL   1.000 DESRPE 0.500

MECH/STRUCT
WS        0.600 WSCF    35.294 MECID   0.000 PRODS  3.875 MCPLXS  5.520
ELECTRONICS
WE        0.400 WECF    27.682 CMPID   0.000 PRODE  4.732 MCPLXE  8.050
PWR       4.000 CMPNTS     60.                PWRFAC 0.767 CMPEFF  9.720

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.064
PRMTHS 121.000 PRMTHF 156.715 AVER. PROD RATE PER MONTH          83.998
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	108.	975.	1083.
CENTER	128.	1193.	1321.
TO	156.	1500.	1656.

MA300 RF MOD8 L DUALT PREAMP

```
INPUT DATA                                      PRICE  836 23-OCT-78   16:11
QTY      4000. PROTOS    40.0 WT        1.000 VOL       0.017 MODE       1.
QTYSYS      4. INTEGE   0.800 INTEGS    0.400 AMULTD  150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.500 MCPLXS   5.520 PRODS     0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE   8.021 PRODE     0.000 NEWEL     1.000 DESRPE   0.400
PWR     4.000 CMPNTS    102. CMPID     0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT     19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE    0.856 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT    1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ     1.000 PDATA     1.000 PTLGTS   1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	18.	2.	20.
DESIGN	58.	6.	64.
SYSTEMS	6.	0.	6.
PROJ MGMT	11.	84.	94.
DATA	3.	4.	7.
SUBTOTAL(ENG)	97.	96.	193.
MANUFACTURING			
PRODUCTION	0.	1346.	1346.
PROTOTYPE	71.	0.	71.
TOOL-TEST EQ	5.	233.	239.
SUBTOTAL(MFG)	77.	1579.	1656.
TOTAL COST	174.	1675.	1848.

```
AVCOST                  0.34           TOTAL AV PROD COST               0.42
WT       1.000 VOL          0.017 ECNS    0.034 NEWST   1.000 DESRPS 0.000
LCURVE   0.856                    ECNE    0.131 NEWEL   1.000 DESRPE 0.400

MECH/STRUCT
WS        0.500 WSCF     29.412 MECID    0.000 PRODS   3.921 MCPLXS   5.520
ELECTRONICS
WE        0.500 WECF     34.602 CMPID    0.000 PRODE   4.550 MCPLXE   8.021
PWR       4.000 CMPNTS     102.                PWRFAC 1.095 CMPEFF   8.936

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.054
PRMTHS 121.000 PRMTHP 158.456 AVER. PROD RATE PER MONTH        106.792
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	146.	1355.	1501.
CENTER	174.	1675.	1848.
TO	214.	2143.	2357.

MA300 RF MOD12 ANT SEL

```
INPUT DATA                              PRICE  836 23-OCT-78   18:13
QTY      1000. PROTOS   10.0 WT       1.000 VOL       0.017 MODE     1.
QTYSYS      1. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.700 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.650 MCPLXE  6.115 PRODE    0.000 NEWEL     1.000 DESRPE   0.200
PWR     2.000 CMPNTS    50. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  103.0 ENMTHP   12.0 ENMTHT   18.0 ECMPLX    0.900 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	17.	2.	18.
DESIGN	52.	5.	57.
SYSTEMS	5.	0.	5.
PROJ MGMT	7.	23.	31.
DATA	3.	1.	4.
SUBTOTAL(ENG)	83.	31.	115.
MANUFACTURING			
PRODUCTION	0.	411.	411.
PROTOTYPE	15.	0.	15.
TOOL-TEST EQ	1.	50.	51.
SUBTOTAL(MFG)	16.	461.	477.
TOTAL COST	100.	492.	592.

```
AVCOST               0.41          TOTAL AV PROD COST              0.49
WT      1.000 VOL        0.017 ECNS    0.027 NEWST   1.000 DESRPS 0.000
LCURVE  0.878                  ECNE    0.106 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS         0.700 WSCF    40.230 MECID   0.000 PRODS  3.842 MCPLXS  5.520
ELECTRONICS
WE         0.300 WECF    20.284 CMPID   0.000 PRODE  5.014 MCPLXE  6.115
PWR        2.000 CMPNTS     50.               PWRFAC 1.080 CMPEFF  4.682

SCHEDULES
ENMTHS 103.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF     0.124
PRMTHS 121.000 PRMTHP 150.866 AVER. PROD RATE PER MONTH          33.483
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	85.	408.	494.
CENTER	100.	492.	592.
TO	119.	605.	724.

```
MA300 RF MOD25 TDM CPLR

INPUT DATA                                  PRICE  83B 23-OCT-78   18:15
QTY      5000. PROTOS   50.0 WT       0.500 VOL       0.009 MODE      1.
QTYSYS      5. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS       0.400 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.650 MCPLXE  8.179 PRODE    0.000 NEWEL     1.000 DESRPE   2.000
PWR      1.000 CMPNTS    30. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   103.0 ENMTHP   12.0 ENMTHT   18.0 ECMPLX    0.900 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE   0.854 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

                                         **********
WECF=     13.523 IS ABNORMAL-CHECK INPUTS
                                         **********

PROGRAM COST           DEVELOPMENT        PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                      13.                 2.              14.
 DESIGN                        39.                 5.              44.
 SYSTEMS                        4.                 0.               4.
 PROJ MGMT                      7.                37.              43.
 DATA                           2.                 2.               4.
  SUBTOTAL(ENG)                64.                45.             109.

MANUFACTURING
 PRODUCTION                     0.               514.             514.
 PROTOTYPE                     29.                 0.              29.
 TOOL-TEST EQ                   2.               148.             151.
  SUBTOTAL(MFG)                31.               663.             694.

  TOTAL COST                   95.               708.             803.

AVCOST                0.10          TOTAL AV PROD COST            0.14
WT       0.500 VOL        0.009 ECNS     0.035 NEWST    1.000 DESRPS 0.000
LCURVE   0.854                  ECNE     0.143 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS       0.400 WSCF    45.977 MECID    0.000 PRODS   3.609 MCPLXS   5.520
ELECTRONICS
WE       0.100 WECF    13.523 CMPID    0.000 PRODE******* MCPLXE   8.179
PWR      1.000 CMPNTS     30.                PWRFAC 1.221 CMPEFF  13.511

SCHEDULES
ENMTHS 103.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF     0.047
PRMTHS 121.000 PRMTHP 160.509 AVER. PROD RATE PER MONTH         126.555

COST RANGES            DEVELOPMENT        PRODUCTION       TOTAL COST
     FROM                      81.               581.             662.
     CENTER                    95.               708.             803.
     TO                       117.               896.            1013.
```

```
MA300 RF MOD30 BITE CPLR

INPUT DATA                                    PRICE  83B 23-OCT-78   18:17
QTY      1000. PROTOS    10.0 WT       0.500 VOL       0.009 MODE      1.
QTYSYS      1. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.250 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.850 MCPLXE   8.177 PRODE    0.000 NEWEL     1.000 DESRPE    0.150
PWR      2.000 CMPNTS     25. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   103.0 ENMTHP    12.0 ENMTHT    18.0 ECMPLX    0.900 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                         16.               2.              17.
 DESIGN                           48.               5.              53.
 SYSTEMS                           5.               0.               5.
 PROJ MGMT                         7.              20.              26.
 DATA                              2.               1.               3.
  SUBTOTAL(ENG)                   77.              27.             105.

MANUFACTURING
 PRODUCTION                        0.             335.             335.
 PROTOTYPE                        12.               0.              12.
 TOOL-TEST EQ                      1.              44.              45.
  SUBTOTAL(MFG)                   13.             378.             391.

  TOTAL COST                      90.             405.             496.

AVCOST                 0.33            TOTAL AV PROD COST            0.41
WT       0.500 VOL         0.009 ECNS    0.027 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                   ECNE    0.108 NEWEL    1.000 DESRPE 0.150

MECH/STRUCT
WS         0.250 WSCF     28.736 MECID   0.000 PRODS   3.927 MCPLXS   5.520
ELECTRONICS
WE         0.250 WECF     33.807 CMPID   0.000 PRODE   4.655 MCPLXE   8.177
PWR        2.000 CMPNTS      25.               PWRFAC 0.679 CMPEFF   3.421

SCHEDULES
ENMTHS 103.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF      0.123
PRMTHS 121.000 PRMTHP 150.797 AVER. PROD RATE PER MONTH          33.560

COST RANGES               DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                         77.             331.             408.
     CENTER                       90.             405.             496.
     TO                          109.             510.             619.
```

```
MA300 RF MOD36 FREQ REF

INPUT DATA                                  PRICE  836 23-OCT-78    18:20
QTY       2000. PROTOS    20.0 WT      1.500 VOL       0.035 MODE      1.
QTYSYS       2. INTEGE   0.800 INTEGS  0.400 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS       0.900 MCPLXS   5.520 PRODS   0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   8.096 PRODE   0.000 NEWEL     1.000 DESRPE    0.100
PWR      6.000 CMPNTS     70. CMPID   0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   103.0 ENMTHP    12.0 ENMTHT   18.0 ECMPLX    0.900 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE  0.862 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROD   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                       28.               3.              31.
 DESIGN                         87.              11.              97.
 SYSTEMS                         8.               0.               8.
 PROJ MGMT                      13.              62.              76.
 DATA                            5.               3.               8.
  SUBTOTAL(ENG)                141.              79.             220.

MANUFACTURING
 PRODUCTION                      0.            1043.            1043.
 PROTOTYPE                      47.               0.              47.
 TOOL-TEST EQ                    4.             144.             148.
  SUBTOTAL(MFG)                 51.            1188.            1239.

  TOTAL COST                   192.            1266.            1458.

AVCOST               0.52          TOTAL AV PROD COST              0.63
WT        1.500 VOL       0.035 ECNS    0.030 NEWST   1.000 DESRPS 0.000
LCURVE    0.862                 ECNE    0.118 NEWEL   1.000 DESRPE 0.100

MECH/STRUCT
WS        0.900 WSCF    25.937 MECID    0.000 PRODS   3.953 MCPLXS  5.520
ELECTRONICS
WE        0.600 WECF    20.342 CMPID    0.000 PRODE   4.999 MCPLXE  8.096
PWR       6.000 CMPNTS     70.                PWRFAC  0.646 CMPEFF  7.825

SCHEDULES
ENMTHS 103.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF      0.081
PRMTHS 121.000 PRMTHP 154.796 AVER. PROD RATE PER MONTH           59.178

COST RANGES             DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                      164.            1045.            1209.
     CENTER                    192.            1266.            1458.
     TO                        229.            1559.            1788.
```

MA300 INT TEST

```
                                              PRICE  838 23-OCT-78   18:22
INPUT DATA
QTY       1000. PROTOS    10.0 IWT       1.194 IVOL       0.019 MODE       5.
QTYSYS       1. INTEGE   0.000 INTEGS    0.000 AMULTD 150.00% AMULTP 150 [illegible]%

MECH/STRUCT
IWS      0.281 MCPLXS    5.279 PRODS     0.000 NEWST      0.300 DESRPS     0.000

ELECTRONICS
I-VVOL   0.999 MCPLXE    7.539 PRODE     0.000 NEWEL      0.500 DESRPE     0.000
PWR      0.000 CMPNTS       0. CMPID     0.000 PWRFAC     0.000 CMPEFF     0.000

ENGINEERING
ENMTHS   102.0 ENMTHP     13.0 ENMTHT     19.0 ECMPLX     0.000 PRNF       0.0[illegible]

PRODUCTION
PRMTHS   121.0 PRMTHP      0.0 LCURVE    0.000 ECNE       0.000 ECNS       0.000

GLOBAL
YEAR     1978. ESC       0.00% PROJCT    1.000 DATA       1.000 TLGTST     1.000
PLTFM    1.800 SYSTEM    1.000 PPROJ     1.000 PDATA      1.000 PTLGTS      1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	20.	3.	23.
DESIGN	66.	8.	74.
SYSTEMS	9.	0.	9.
PROJ MGMT	9.	37.	45.
DATA	3.	2.	5.
SUBTOTAL(ENG)	108.	49.	157.
MANUFACTURING			
PRODUCTION	0.	695.	695.
PROTOTYPE	22.	0.	22.
TOOL-TEST EQ	2.	38.	40.
SUBTOTAL(MFG)	25.	733.	757.
TOTAL COST	133.	782.	915.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	109.	604.	713.
CENTER	133.	782.	915.
TO	173.	1103.	1275.

TOTAL COST, LESS INTEGRATION COST

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	168.	18.	186.
DESIGN	525.	57.	582.
SYSTEMS	52.	0.	52.
PROJ MGMT	82.	436.	518.
DATA	28.	20.	48.
SUBTOTAL(ENG)	856.	531.	1387.
MANUFACTURING			
PRODUCTION	0.	7140.	7140.
PROTOTYPE	341.	0.	341.
TOOL-TEST EQ	27.	1168.	1195.
PURCH ITEMS	0.	0.	0.
SUBTOTAL(MFG)	368.	8308.	8676.
TOTAL COST	1224.	8839.	10062.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	1040.	7227.	8267.
CENTER	1224.	8839.	10062.
TO	1483.	11112.	12595.

TOTAL COST, WITH INTEGRATION COST

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	189.	21.	209.
DESIGN	591.	65.	656.
SYSTEMS	62.	0.	62.
PROJ MGMT	91.	472.	564.
DATA	31.	22.	53.
SUBTOTAL(ENG)	964.	580.	1544.
MANUFACTURING			
PRODUCTION	0.	7835.	7835.
PROTOTYPE	363.	0.	363.
TOOL-TEST EQ	29.	1205.	1235.
PURCH ITEMS	0.	0.	0.
SUBTOTAL(MFG)	393.	9041.	9433.
TOTAL COST	1356.	9621.	10977.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	1149.	7831.	8980.
CENTER	1356.	9621.	10977.
TO	1655.	12215.	13870.

FUNCTION:

```
MA300 RF MOD2 ELE WTG CORR

INPUT DATA                                      PRICE  83B  6-OCT-78   12:46
QTY       2000. PROTOS   20.0 WT       8.000 VOL       0.156 MODE       1.
QTYSYS       2. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       2.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.021 PRODE    0.000 NEWEL     1.000 DESRPE   0.700
PWR    10.000 CMPNTS   150. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   85.0 ENMTHP   28.0 ENMTHT   36.0 ECMPLX    2.200 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS   1.00

PROGRAM COST            DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                      115.                6.              121.
 DESIGN                        480.               17.              497.
 SYSTEMS                       137.                0.              137.
 PROJ MGMT                     187.              432.              619.
 DATA                           68.               20.               88.
  SUBTOTAL(ENG)                988.              474.             1462.

MANUFACTURING
 PRODUCTION                      0.             8078.             8078.
 PROTOTYPE                     460.                0.              460.
 TOOL-TEST EQ                   56.              348.              404.
  SUBTOTAL(MFG)                516.             8426.             8942.

  TOTAL COST                  1504.             8900.            10404.

AVCOST                4.04          TOTAL AV PROD COST             4.45
WT       8.000 VOL       0.156 ECNS    0.034 NEWST   1.000 DESRPS 0.000
LCURVE   0.878                 ECNE    0.130 NEWEL   1.000 DESRPE 0.700

MECH/STRUCT
WS       2.000 WSCF     12.821 MECID   0.000 PRODS   4.139 MCPLXS   5.520
ELECTRONICS
WE       6.000 WECF     45.249 CMPID   0.000 PRODE   4.358 MCPLXE   8.021
PWR     10.000 CMPNTS     150.                PWRFAC 0.767 CMPEFF-25.461

SCHEDULES
ENMTHS  85.000 ENMTHP  28.000 ENMTHT 36.000 ECMPLX 2.200 PRNF      0.108
PRMTHS 121.000 PRMTHP 155.730 AVER. PROD RATE PER MONTH           57.587

COST RANGES             DEVELOPMENT        PRODUCTION        TOTAL COST
      FROM                    1266.             7033.             8300.
      CENTER                  1504.             8900.            10404.
      TO                      1858.            11766.            13624.
```

```
MA300 RF MOD3 GPS PN CORR

INPUT DATA                                PRICE  83B  6-OCT-78   12:48
QTY      5000. PROTOS   50.0 WT       1.250 VOL       0.017 MODE     1.
QTYSYS      5. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.625 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE   8.116 PRODE    0.000 NEWEL     1.000 DESRPE   0.200
PWR     3.000 CMPNTS     60. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   84.0 ENMTHP    29.0 ENMTHT    37.0 ECMPLX    2.200 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF     0.0 LCURVE   0.854 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                      66.               4.              70.
 DESIGN                       278.              11.             289.
 SYSTEMS                       78.               0.              78.
 PROJ MGMT                     93.             131.             224.
 DATA                          36.               6.              42.
  SUBTOTAL(ENG)               550.             152.             702.

MANUFACTURING
 PRODUCTION                     0.            2063.            2063.
 PROTOTYPE                    170.               0.             170.
 TOOL-TEST EQ                  20.             362.             383.
  SUBTOTAL(MFG)               190.            2426.            2616.

  TOTAL COST                  740.            2577.            3318.

AVCOST               0.41          TOTAL AV PROD COST            0.52
WT      1.250 VOL        0.017 ECNS    0.037 NEWST   1.000 DESRPS 0.000
LCURVE  0.854                  ECNE    0.150 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS        0.625 WSCF    36.765 MECID   0.000 PRODS  3.865 MCPLXS  5.520
ELECTRONICS
WE        0.625 WECF    43.253 CMPID   0.000 PRODE  4.442 MCPLXE  8.116
PWR       3.000 CMPNTS     60.               PWRFAC 0.930 CMPEFF -3.256

SCHEDULES
ENMTHS  84.000 ENMTHP  29.000 ENMTHT 37.000 ECMPLX 2.200 PRNF    0.062
PRMTHS 121.000 PRMTHF 161.105 AVER. PROD RATE PER MONTH        124.673

COST RANGES            DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                     630.            2062.            2692.
     CENTER                   740.            2577.            3318.
     TO                       904.            3359.            4263.
```

```
MA300 RF MOD4 VAR FREQ IF

INPUT DATA                                  PRICE  83B  6-OCT-78   12:50
QTY     17000. PROTOS  170.0 WT       1.500 VOL       0.017 MODE      1.
QTYSYS     17. INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.600 MCPLXS  5.520 PRODS   0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE  8.115 PRODE   0.000 NEWEL     1.000 DESRPE   0.200
PWR      3.000 CMPNTS   100. CMPID   0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.834 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                       37.                6.               42.
 DESIGN                        117.               16.              133.
 SYSTEMS                        13.                0.               13.
 PROJ MGMT                      39.              451.              491.
 DATA                           10.               21.               31.
  SUBTOTAL(ENG)                216.              493.              710.

MANUFACTURING
 PRODUCTION                      0.             5419.             5419.
 PROTOTYPE                     468.                0.              468.
 TOOL-TEST EQ                   34.             2251.             2285.
  SUBTOTAL(MFG)                503.             7669.             8172.

  TOTAL COST                   719.             8163.             8881.

AVCOST                0.32            TOTAL AV PROD COST            0.48
WT       1.500 VOL        0.017 ECNS    0.042 NEWST    1.000 DESRPS 0.000
LCURVE   0.834                  ECNE    0.173 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS       0.600  WSCF    34.483 MECID    0.000 PRODS   3.881 MCPLXS  5.520
ELECTRONICS
WE       0.900  WECF    60.852 CMPID    0.000 PRODE   4.205 MCPLXE  8.115
PWR      3.000  CMPNTS    100.                PWRFAC  1.310 CMPEFF -7.119

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.023
PRMTHS 121.000 PRMTHP 172.044 AVER. PROD RATE PER MONTH         333.047

COST RANGES             DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                      587.             6340.             6927.
     CENTER                    719.             8163.             8881.
     TO                        928.            11174.            12101.
```

```
MA300 RF MODS 70 MHZ IF

INPUT DATA                                 PRICE  838  6-OCT-78   12:51
QTY     17000. PROTOS   170.0 WT       1.500 VOL        0.017 MODE      1.
QTYSYS     17. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.600 MCPLXS   5.520 PRODS    0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   8.050 PRODE    0.000 NEWEL      1.000 DESRPE    0.200
PWR      4.000 CMPNTS    100. CMPID    0.000 PWRFAC     0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX     1.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.834 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA       1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST             DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        36.                5.               42.
 DESIGN                         116.               15.              131.
 SYSTEMS                         13.                0.               13.
 PROJ MGMT                       38.              427.              465.
 DATA                            10.               20.               30.
  SUBTOTAL(ENG)                 213.              467.              680.

MANUFACTURING
 PRODUCTION                       0.             5139.             5139.
 PROTOTYPE                      449.                0.              449.
 TOOL-TEST EQ                    33.             2126.             2159.
  SUBTOTAL(MFG)                 482.             7266.             7748.

  TOTAL COST                    695.             7733.             8428.

AVCOST              0.30            TOTAL AV PROD COST              0.45
WT        1.500 VOL        0.017 ECNS     0.042 NEWST    1.000 DESRPS 0.000
LCURVE  0.834                   ECNE     0.168 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS        0.600 WSCF    34.483 MECID    0.000 PRODS   3.881 MCPLXS   5.520
ELECTRONICS
WE        0.900 WECF    60.852 CMPID    0.000 PRODE   4.172 MCPLXE   8.050
PWR       4.000 CMPNTS    100.                PWRFAC  1.080 CMPEFF  -2.952

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.023
PRMTHS 121.000 PRMTHP 171.421 AVER. PROD RATE PER MONTH          337.159

COST RANGES              DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                        567.             6007.             6575.
     CENTER                      695.             7733.             8428.
     TO                          898.            10609.            11508.
```

```
MA300 RF MODS L ELE WTG

INPUT DATA                                   PRICE  83B  6-OCT-78   12:53
QTY      1000. PROTOS   10.0 WT      12.000 VOL      0.208 MODE      1.
QTYSYS      1. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       4.000 MCPLXS  5.520 PRODS    0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  7.440 PRODE    0.000 NEWEL    1.000 DESRPE   0.600
PWR    15.000 CMPNTS   168. CMPID    0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   87.0 ENMTHP   26.0 ENMTHT   34.0 ECMPLX   2.200 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.878 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.600 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                    148.                5.              152.
 DESIGN                      607.               13.              619.
 SYSTEMS                     183.                0.              183.
 PROJ MGMT                   198.              187.              385.
 DATA                         81.                9.               90.
  SUBTOTAL(ENG)             1216.              213.             1429.

MANUFACTURING
 PRODUCTION                    0.             3674.             3674.
 PROTOTYPE                   218.                0.              218.
 TOOL-TEST EQ                 27.              147.              174.
  SUBTOTAL(MFG)              245.             3822.             4067.

  TOTAL COST                1461.             4034.             5496.

AVCOST              3.67          TOTAL AV PROD COST                4.03
WT      12.000 VOL        0.208 ECNS    0.028 NEWST   1.000 DESRPS 0.000
LCURVE  0.878                   ECNE    0.085 NEWEL   1.000 DESRPE 0.600

MECH/STRUCT
WS       4.000 WSCF     19.231 MECID    0.000 PRODS  4.031 MCPLXS   5.520
ELECTRONICS
WE       8.000 WECF     45.249 CMPID    0.000 PRODE  4.043 MCPLXE   7.440
PWR     15.000 CMPNTS     168.                PWRFAC 0.631 CMPEFF-21.628

SCHEDULES
ENMTHS  87.000 ENMTHP  26.000 ENMTHT 34.000 ECMPLX 2.200 PRNF     0.179
PRMTHS 121.000 PRMTHP 148.824 AVER. PROD RATE PER MONTH          35.940

COST RANGES            DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                   1232.             3178.             4411.
     CENTER                 1461.             4034.             5496.
     TO                     1822.             5467.             7289.
```

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MA300 RF MOD10 FHOP SYNTH

INPUT DATA                                  PRICE  83B  6-OCT-78   12:55
QTY      2000. PROTOS   20.0 WT       2.000 VOL       0.035 MODE       1.
QTYSYS      2. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.074 PRODE    0.000 NEWEL     1.000 DESRPE   0.200
PWR    10.000 CMPNTS   280. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   96.0 ENMTHP   19.0 ENMTHT   25.0 ECMPLX    1.500 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.862 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROD   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST          DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                     58.               4.              62.
 DESIGN                      210.              13.             223.
 SYSTEMS                      38.               0.              38.
 PROJ MGMT                    38.              92.             130.
 DATA                         14.               4.              18.
  SUBTOTAL(ENG)              358.             113.             471.

MANUFACTURING
 PRODUCTION                    0.            1593.            1593.
 PROTOTYPE                    85.               0.              85.
 TOOL-TEST EQ                  9.             191.             200.
  SUBTOTAL(MFG)               94.            1785.            1879.

  TOTAL COST                 452.            1898.            2350.

AVCOST               0.80          TOTAL AV PROD COST           0.95
WT      2.000 VOL        0.035 ECNS    0.032 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                  ECNE    0.123 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS       1.000 WSCF    28.571 MECID   0.000 PRODS  3.928 MCPLXS  5.520
ELECTRONICS
WE       1.000 WECF    33.613 CMPID   0.000 PRODE  4.601 MCPLXE  8.074
PWR     10.000 CMPNTS    280.                PWRFAC 1.165 CMPEFF 13.648

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF    0.081
PRMTHS 121.000 PRMTHP 154.929 AVER. PROD RATE PER MONTH         58.947

COST RANGES           DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                    385.            1533.            1918.
     CENTER                  452.            1898.            2350.
     TO                      549.            2423.            2972.
```

```
MA300 RF MOD11 SHOP SYNTH

INPUT DATA                                  PRICE  83B  6-OCT-78   12:57
QTY     10000. PROTOS  100.0 WT        2.000 VOL       0.035 MODE        1.
QTYSYS     10. INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.000 MCPLXS  5.520 PRODS     0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.249 PRODE     0.000 NEWEL     1.000 DESRPE    0.200
PWR     4.000 CMPNTS   120. CMPID     0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.846 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS     1.00

PROGRAM COST           DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                      41.               6.              47.
 DESIGN                       131.              20.             151.
 SYSTEMS                       14.               0.              14.
 PROJ MGMT                     34.             372.             407.
 DATA                          10.              17.              27.
  SUBTOTAL(ENG)               229.             415.             645.

MANUFACTURING
 PRODUCTION                     0.            5462.            5462.
 PROTOTYPE                    352.               0.             352.
 TOOL-TEST EQ                  27.            1166.            1193.
  SUBTOTAL(MFG)               379.            6628.            7006.

  TOTAL COST                  608.            7043.            7651.

AVCOST                 0.55           TOTAL AV PROD COST            0.70
WT       2.000 VOL          0.035 ECNS    0.041 NEWST    1.000 DESRPS 0.000
LCURVE  0.846                     ECNE    0.173 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS        1.000 WSCF    28.571 MECID   0.000 PRODS  3.928 MCPLXS  5.520
ELECTRONICS
WE        1.000 WECF    33.613 CMPID   0.000 PRODE  4.701 MCPLXE  8.249
PWR       4.000 CMPNTS    120.                PWRFAC 1.221 CMPEFF -4.951

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.031
PRMTHS 121.000 PRMTHP 166.349 AVER. PROD RATE PER MONTH         211.198

COST RANGES            DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                     508.            5655.            6163.
     CENTER                   608.            7043.            7651.
     TO                       750.            9008.            9757.
```

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MA300 RF MOD14 L TRAN

INPUT DATA                              PRICE  83B  6-OCT-78    12:59
QTY      1000. PROTOS    10.0 WT       9.000 VOL       0.087 MODE      1.
QTYSYS      1. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       7.000 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.600 MCPLXE   8.176 PRODE    0.000 NEWEL     1.000 DESRPE   0.100
PWR     90.000 CMPNTS    250. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    95.0 ENMTHP    20.0 ENMTHT    26.0 ECMPLX    1.500 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF     0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROG    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                     121.                8.              129.
 DESIGN                       440.               24.              464.
 SYSTEMS                       78.                0.               78.
 PROJ MGMT                     73.              129.              202.
 DATA                          28.                6.               34.
  SUBTOTAL(ENG)               739.              166.              906.

MANUFACTURING
 PRODUCTION                     0.             2442.             2442.
 PROTOTYPE                    113.                0.              113.
 TOOL-TEST EQ                  13.              110.              123.
  SUBTOTAL(MFG)               126.             2552.             2678.

  TOTAL COST                  865.             2719.             3584.

AVCOST              2.44             TOTAL AV PROD COST            2.72
WT       9.000 VOL        0.087 ECNS     0.030 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                  ECNE     0.118 NEWEL    1.000 DESRPE 0.100

MECH/STRUCT
WS        7.000 WSCF     80.460 MECID    0.000 PRODS   3.673 MCPLXS   5.520
ELECTRONICS
WE        2.000 WECF     38.314 CMPID    0.000 PRODE   4.563 MCPLXE   8.176
PWR      90.000 CMPNTS    250.                 PWRFAC 0.248 CMPEFF 27.707

SCHEDULES
ENMTHS   95.000 ENMTHP  20.000 ENMTHT 26.000 ECMPLX 1.500 PRNF      0.122
PRMTHS  121.000 PRMTHF 152.627 AVER. PROD RATE PER MONTH          31.619

COST RANGES            DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                     736.             2180.             2915.
     CENTER                   865.             2719.             3584.
     TO                      1056.             3534.             4590.
```

MA300 RF MOD15 UHF DUALT PREAMP

INPUT DATA						PRICE 836	6-OCT-78	13:00	
QTY	5000.	PROTOS	50.0	WT	1.250	VOL	0.017	MODE	1.
QTYSYS	5.	INTEGE	0.800	INTEGS	0.800	AMULTD	150.00%	AMULTP	150.00%

MECH/STRUCT									
WS	0.625	MCPLXS	5.520	PRODS	0.000	NEWST	1.000	DESRPS	2.000
ELECTRONICS									
USEVOL	0.850	MCPLXE	8.074	PRODE	0.000	NEWEL	1.000	DESRPE	0.500
PWR	3.000	CMPNTS	120.	CMPID	0.000	PWRFAC	0.000	CMPEFF	0.000
ENGINEERING									
ENMTHS	102.0	ENMTHP	13.0	ENMTHT	19.0	ECMPLX	1.000	PRNF	0.000
PRODUCTION									
PRMTHS	121.0	PRMTHP	0.0	LCURVE	0.854	ECNE	0.000	ECNS	0.000
GLOBAL									
YEAR	1978.	ESC	0.00%	PROJCT	1.000	DATA	1.000	TLGTST	1.000
PLTFM	1.800	SYSTEM	1.000	PPROJ	1.000	PDATA	1.000	PTLGTS	1.00

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	19.	2.	21.
DESIGN	60.	6.	66.
SYSTEMS	6.	0.	6.
PROJ MGMT	13.	126.	139.
DATA	4.	6.	10.
SUBTOTAL(ENG)	102.	140.	242.
MANUFACTURING			
PRODUCTION	0.	1981.	1981.
PROTOTYPE	110.	0.	110.
TOOL-TEST EQ	8.	349.	357.
SUBTOTAL(MFG)	118.	2330.	2448.
TOTAL COST	220.	2470.	2690.

AVCOST		0.40		TOTAL AV PROD COST				0.49
WT	1.250	VOL	0.017	ECNS	0.036	NEWST	1.000	DESRPS 0.000
LCURVE	0.854			ECNE	0.140	NEWEL	1.000	DESRPE 0.500

MECH/STRUCT									
WS	0.625	WSCF	36.765	MECID	0.000	PRODS	3.865	MCPLXS	5.520
ELECTRONICS									
WE	0.625	WECF	43.253	CMPID	0.000	PRODE	4.419	MCPLXE	8.074
PWR	3.000	CMPNTS	120.			PWRFAC	1.480	CMPEFF	1.491
SCHEDULES									
ENMTHS	102.000	ENMTHP	13.000	ENMTHT	19.000	ECMPLX	1.000	PRNF	0.047
PRMTHS	121.000	PRMTHP	160.639	AVERG PROD RATE PER MONTH					126.137

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	183.	1976.	2159.
CENTER	220.	2470.	2690.
TO	275.	3224.	3499.

MA300 RF MOD16 UHF WTG

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INPUT DATA                                   PRICE  83B  6-OCT-78   13:02
QTY       1000. PROTOS    10.0 WT        8.000 VOL      0.122 MODE      1.
QTYSYS       1. INTEGE   0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       2.000 MCPLXS   5.520 PRODS     0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.650 MCPLXE   8.021 PRODE     0.000 NEWEL     1.000 DESRPE    0.700
PWR     10.000 CMPNTS    150. CMPID     0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS    85.0 ENMTHP    28.0 ENMTHT    36.0 ECMPLX    2.200 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS     1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	115.	5.	120.
DESIGN	482.	14.	496.
SYSTEMS	138.	0.	138.
PROJ MGMT	157.	239.	396.
DATA	62.	11.	73.
SUBTOTAL(ENG)	954.	269.	1223.
MANUFACTURING			
PRODUCTION	0.	4601.	4601.
PROTOTYPE	246.	0.	246.
TOOL-TEST EQ	33.	197.	230.
SUBTOTAL(MFG)	279.	4797.	5076.
TOTAL COST	1233.	5066.	6299.

```
AVCOST              4.60          TOTAL AV PROD COST              5.07
WT       8.000 VOL        0.122 ECNS     0.030 NEWST    1.000 DESRPS 0.000
LCURVE  0.878                   ECNE     0.111 NEWEL    1.000 DESRPE 0.700

MECH/STRUCT
WS        2.000 WSCF    16.393 MECID    0.000 PRODS   4.073 MCPLXS   5.520
ELECTRONICS
WE        6.000 WECF    57.859 CMPID    0.000 PRODE   4.190 MCPLXE   8.021
PWR      10.000 CMPNTS    150.                PWRFAC 0.767 CMPEFF-25.461

SCHEDULES
ENMTHS  85.000 ENMTHP  28.000 ENMTHT 36.000 ECMPLX 2.200 PRNF      0.166
PRMTHS 121.000 PRMTHF 151.793 AVER. PROD RATE PER MONTH           32.475
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	1039.	3961.	5000.
CENTER	1233.	5066.	6299.
TO	1530.	6860.	8390.

```
MA300 RF MOD17 UHF TRAN

INPUT DATA                              PRICE  83B  6-OCT-78   13:04
QTY       2000. PROTOS   20.0 WT       4.000 VOL       0.052 MODE      1.
QTYSYS       2. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        3.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.600 MCPLXE  8.197 PRODE    0.000 NEWEL     1.000 DESRPE   0.100
PWR    12.000 CMPNTS   100. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF    0.0 LCURVE  0.862 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT       PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                       49.               5.               54.
 DESIGN                        155.              16.              172.
 SYSTEMS                        17.               0.               17.
 PROJ MGMT                      23.             112.              134.
 DATA                            8.               5.               13.
  SUBTOTAL(ENG)                251.             138.              390.

MANUFACTURING
 PRODUCTION                      0.            1966.             1966.
 PROTOTYPE                      91.               0.               91.
 TOOL-TEST EQ                    8.             181.              189.
  SUBTOTAL(MFG)                 99.            2147.             2245.

  TOTAL COST                   350.            2285.             2635.

AVCOST               0.98          TOTAL AV PROD COST               1.14
WT        4.000 VOL       0.052 ECNS    0.032 NEWST    1.000 DESRPS 0.000
LCURVE  0.862                   ECNE    0.127 NEWEL    1.000 DESRPE 0.100

MECH/STRUCT
WS         3.000 WSCF    57.582 MECID    0.000 PRODS  3.754 MCPLXS  5.520
ELECTRONICS
WE         1.000 WECF    31.990 CMPID    0.000 PRODE  4.708 MCPLXE  8.197
PWR       12.000 CMPNTS    100.                PWRFAC 0.517 CMPEFF  8.669

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.080
PRMTHS 121.000 PRMTHF 156.146 AVER. PROD RATE PER MONTH          56.902

COST RANGES             DEVELOPMENT       PRODUCTION        TOTAL COST
     FROM                      297.            1846.             2143.
     CENTER                    350.            2285.             2635.
     TO                        426.            2920.             3346.
```

```
MA300 RF MOD1S MULTI 6A EX

INPUT DATA                                  PRICE  83B  6-OCT-78   13:06
QTY       3000. PROTOS   30.0 WT      1.500 VOL      0.017 MODE      1.
QTYSYS       3. INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.600 MCPLXS  5.520 PRODS   0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE  8.115 PRODE   0.000 NEWEL    1.000 DESRPE   0.200
PWR      6.000 CMPNTS    80. CMPID   0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX   1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.858 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	37.	4.	41.
DESIGN	118.	12.	130.
SYSTEMS	13.	0.	13.
PROJ MGMT	19.	117.	136.
DATA	6.	6.	12.
SUBTOTAL(ENG)	192.	139.	332.
MANUFACTURING			
PRODUCTION	0.	1917.	1917.
PROTOTYPE	94.	0.	94.
TOOL-TEST EQ	7.	273.	280.
SUBTOTAL(MFG)	101.	2190.	2291.
TOTAL COST	293.	2329.	2623.

```
AVCOST                0.64          TOTAL AV PROD COST           0.78
WT        1.500 VOL         0.017 ECNS    0.033 NEWST   1.000 DESRPS 0.000
LCURVE  0.858                     ECNE    0.130 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS        0.600 WSCF    35.294 MECID    0.000 PRODS  3.875 MCPLXS  5.520
ELECTRONICS
WE        0.900 WECF    62.284 CMPID    0.000 PRODE  4.190 MCPLXE  8.115
PWR       6.000 CMPNTS     80.                PWRFAC 0.709 CMPEFF  0.590

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF    0.063
PRMTHS 121.000 PRMTHF 157.494 AVER. PROD RATE PER MONTH         82.206
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	244.	1833.	2077.
CENTER	293.	2329.	2623.
TO	370.	3139.	3509.

```
MA300 RF MOD19 VHF AM TRAN

INPUT DATA                                   PRICE  836  6-OCT-78   13:08
QTY      1000. PROTOS   10.0 WT       4.000 VOL        0.052 MODE      1.
QTYSYS      1. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       3.000 MCPLXS  5.520 PRODS    0.000 NEWST      1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.600 MCPLXE  8.196 PRODE    0.000 NEWEL      1.000 DESRPE   0.100
PWR     10.000 CMPNTS   100. CMPID    0.000 PWRFAC     0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT    19.0 ECMPLX     1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE   0.878 ECNE       0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PRODCT   1.000 DATA       1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROD    1.000 PDATA      1.000 PTLGTS    1.00

PROGRAM COST             DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        49.                5.               53.
 DESIGN                         155.               15.              170.
 SYSTEMS                         17.                0.               17.
 PROJ MGMT                       20.               70.               90.
 DATA                             7.                3.               11.
  SUBTOTAL(ENG)                 248.               93.              341.

MANUFACTURING
 PRODUCTION                       0.             1315.             1315.
 PROTOTYPE                       49.                0.               49.
 TOOL-TEST EQ                     5.               72.               77.
  SUBTOTAL(MFG)                  53.             1388.             1441.

  TOTAL COST                    302.             1480.             1782.

AVCOST               1.32          TOTAL AV PROD COST              1.48
WT       4.000 VOL        0.052 ECNS    0.029 NEWST   1.000 DESRPS 0.000
LCURVE   0.878                  ECNE    0.114 NEWEL   1.000 DESRPE 0.100

MECH/STRUCT
WS        3.000 WSCF     57.582 MECID   0.000 PRODS   3.754 MCPLXS  5.520
ELECTRONICS
WE        1.000 WECF     31.990 CMPID   0.000 PRODE   4.708 MCPLXE  8.196
PWR      10.000 CMPNTS     100.               PWRFAC  0.585 CMPEFF  6.265

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.122
PRMTHS 121.000 PRMTHP 152.174 AVER. PROD RATE PER MONTH          32.078

COST RANGES              DEVELOPMENT        PRODUCTION        TOTAL COST
      FROM                      257.             1199.             1456.
      CENTER                    302.             1480.             1782.
      TO                        365.             1887.             2252.
```

```
MA300 RF MOD20 VHF FM TRAN

INPUT DATA                                  PRICE  83B  6-OCT-78   13:09
QTY      1000. PROTOS   10.0 WT       3.000 VOL       0.034 MODE      1.
QTYSYS      1. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS       2.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.600 MCPLXE  8.200 PRODE    0.000 NEWEL     1.000 DESRPE   0.150
PWR      8.000 CMPNTS    93. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF    0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST             DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        45.                4.               49.
 DESIGN                         143.               13.              156.
 SYSTEMS                         15.                0.               15.
 PROJ MGMT                       19.               67.               86.
 DATA                             7.                3.               10.
  SUBTOTAL(ENG)                 229.               88.              317.

MANUFACTURING
 PRODUCTION                       0.             1249.             1249.
 PROTOTYPE                       45.                0.               45.
 TOOL-TEST EQ                     4.               73.               78.
  SUBTOTAL(MFG)                  50.             1322.             1372.

  TOTAL COST                    279.             1410.             1689.

AVCOST                 1.25             TOTAL AV PROD COST          1.41
WT       3.000 VOL          0.034 ECNS    0.029 NEWST   1.000 DESRPS 0.000
LCURVE   0.878                    ECNE    0.113 NEWEL   1.000 DESRPE 0.150

MECH/STRUCT
WS        2.000 WSCF    58.824 MECID    0.000 PRODS  3.746 MCPLXS  5.520
ELECTRONICS
WE        1.000 WECF    49.020 CMPID    0.000 PRODE  4.399 MCPLXE  8.200
PWR       8.000 CMPNTS     93.                PWRFAC 0.647 CMPEFF  2.821

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.122
PRMTHS 121.000 PRMTHF 152.023 AVER. PROD RATE PER MONTH          32.234

COST RANGES              DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                       236.             1124.             1360.
     CENTER                     279.             1410.             1689.
     TO                         343.             1851.             2194.
```

```
MA300 RF MOD21 HF TRAN

INPUT DATA                                  PRICE  83B  6-OCT-78   13:11
QTY       1000. PROTOS    10.0 WT        6.000 VOL        0.087 MODE       1.
QTYSYS       1. INTEGE   0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        5.000 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS     2.000

ELECTRONICS
USEVOL    0.600 MCPLXE   8.196 PRODE     0.000 NEWEL      1.000 DESRPE     0.150
PWR      80.000 CMPNTS    100. CMPID     0.000 PWRFAC     0.000 CMPEFF     0.000

ENGINEERING
ENMTHS    102.0 ENMTHP    13.0 ENMTHT     19.0 ECMPLX     1.000 PRNF       0.000

PRODUCTION
PRMTHS    121.0 PRMTHP     0.0 LCURVE    0.878 ECNE       0.000 ECNS       0.000

GLOBAL
YEAR      1978. ESC      0.00% PROJCT    1.000 DATA       1.000 TLGTST     1.000
PLTFM     1.800 SYSTEM   1.000 PPROJ     1.000 PDATA      1.000 PTLGTS      1.00

PROGRAM COST           DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                      49.               4.              53.
 DESIGN                       156.              15.             172.
 SYSTEMS                       17.               0.              17.
 PROJ MGMT                     21.              75.              96.
 DATA                           7.               4.              11.
  SUBTOTAL(ENG)               251.              99.             349.

MANUFACTURING
 PRODUCTION                     0.            1445.            1445.
 PROTOTYPE                     55.               0.              55.
 TOOL-TEST EQ                   5.              74.              79.
  SUBTOTAL(MFG)                60.            1519.            1579.

  TOTAL COST                  311.            1618.            1928.

AVCOST                1.45           TOTAL AV PROD COST           1.62
WT        6.000 VOL          0.087 ECNS     0.029 NEWST    1.000 DESRPS 0.000
LCURVE    0.878                    ECNE     0.114 NEWEL    1.000 DESRPE 0.150

MECH/STRUCT
WS          5.000 WSCF      57.604 MECID    0.000 PRODS  3.753 MCPLXS   5.520
ELECTRONICS
WE          1.000 WECF      19.201 CMPID    0.000 PRODE  5.108 MCPLXE   8.196
PWR        80.000 CMPNTS      100.                PWRFAC 0.145 CMPEFF  33.748

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF          0.122
PRMTHS 121.000 PRMTHP 152.419 AVER. PROD RATE PER MONTH              31.828

COST RANGES            DEVELOPMENT       PRODUCTION       TOTAL COST
      FROM                    267.            1329.            1596.
      CENTER                  311.            1618.            1928.
      TO                      372.            2013.            2385.
```

MA300 RF MOD22 VHF AM DUALT PREAMP

```
INPUT DATA                                   PRICE  83B  6-OCT-78   13:13
QTY      2000. PROTOS   20.0 WT       1.250 VOL      0.017 MODE      1.
QTYSYS      2. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.625 MCPLXS  5.520 PRODS    0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.700 MCPLXE  8.226 PRODE    0.000 NEWEL    1.000 DESRPE   0.400
PWR      3.000 CMPNTS   120. CMPID    0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.862 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS   1.00

PROGRAM COST            DEVELOPMENT       PRODUCTION      TOTAL COST
ENGINEERING
 DRAFTING                       23.               3.             26.
 DESIGN                         75.               7.             82.
 SYSTEMS                         8.               0.              8.
 PROJ MGMT                      11.              70.             82.
 DATA                            4.               3.              7.
  SUBTOTAL(ENG)                122.              83.            205.

MANUFACTURING
 PRODUCTION                      0.            1185.           1185.
 PROTOTYPE                      52.               0.             52.
 TOOL-TEST EQ                    4.             157.            161.
  SUBTOTAL(MFG)                 57.            1342.           1399.

  TOTAL COST                   178.            1425.           1604.

AVCOST                 0.59               TOTAL AV PROD COST           0.71
WT       1.250 VOL        0.017 ECNS    0.031 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                 ECNE    0.127 NEWEL   1.000 DESRPE 0.400

MECH/STRUCT
WS        0.625 WSCF    36.765 MECID   0.000 PRODS  3.865 MCPLXS   5.520
ELECTRONICS
WE        0.625 WECF    52.521 CMPID   0.000 PRODE  4.365 MCPLXE   8.226
PWR       3.000 CMPNTS    120.                 PWRFAC 1.480 CMPEFF   0.645

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.079
PRMTHS 121.000 PRMTHP 155.481 AVER. PROD RATE PER MONTH           58.002

COST RANGES             DEVELOPMENT       PRODUCTION      TOTAL COST
      FROM                     150.            1135.           1285.
      CENTER                   178.            1425.           1604.
      TO                       222.            1875.           2097.
```

```
MA300 RF MOD23 VHF FM DUALT PREAMP

INPUT DATA                                  PRICE  836   6-OCT-78    13:15
QTY      1000. PROTOS    10.0 WT        1.250 VOL        0.017 MODE       1.
QTYSYS      1. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.625 MCPLXS   5.520 PRODS    0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   8.074 PRODE    0.000 NEWEL      1.000 DESRPE    0.500
PWR      3.000 CMPNTS    120. CMPID    0.000 PWRFAC     0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX     1.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA       1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                         19.                 2.               20.
 DESIGN                           60.                 5.               64.
 SYSTEMS                           6.                 0.                6.
 PROJ MGMT                         8.                38.               47.
 DATA                              3.                 2.                5.
  SUBTOTAL(ENG)                   96.                47.              143.

MANUFACTURING
 PRODUCTION                        0.               704.              704.
 PROTOTYPE                        25.                 0.               25.
 TOOL-TEST EQ                      2.                65.               67.
  SUBTOTAL(MFG)                   28.               769.              797.

  TOTAL COST                     124.               816.              939.

AVCOST                  0.70            TOTAL AV PROD COST             0.82
WT       1.250 VOL         0.017 ECNS    0.028 NEWST   1.000 DESRPS 0.000
LCURVE   0.878                 ECNE    0.106 NEWEL   1.000 DESRPE 0.500

MECH/STRUCT
WS        0.625 WSCF     35.920 MECID    0.000 PRODS  3.870 MCPLXS   5.520
ELECTRONICS
WE        0.625 WECF     42.258 CMPID    0.000 PRODE  4.436 MCPLXE   8.074
PWR       3.000 CMPNTS    120.                 PWRFAC 1.480 CMPEFF   1.491

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.124
PRMTHS 121.000 PRMTHP 150.808 AVER. PROD RATE PER MONTH          33.548

COST RANGES               DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                        105.               657.              761.
     CENTER                      124.               816.              939.
     TO                          152.              1056.             1208.
```

```
MA300 RF MOD24 HF DUALT PREAMP

INPUT DATA                                   PRICE  83B  6-OCT-78    13:17
QTY       1000. PROTOS   10.0 WT       1.250 VOL       0.017 MODE       1.
QTYSYS       1. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS       0.625 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   8.115 PRODE    0.000 NEWEL     1.000 DESRPE   0.300
PWR      4.000 CMPNTS    105. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF     0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                       25.                2.                28.
 DESIGN                         80.                7.                87.
 SYSTEMS                         9.                0.                 9.
 PROJ MGMT                      11.               40.                51.
 DATA                            4.                2.                 6.
  SUBTOTAL(ENG)                129.               51.               180.

MANUFACTURING
 PRODUCTION                      0.              727.               727.
 PROTOTYPE                      26.                0.                26.
 TOOL-TEST EQ                    2.               66.                69.
  SUBTOTAL(MFG)                 28.              793.               822.

  TOTAL COST                   157.              844.              1002.

AVCOST               0.73            TOTAL AV PROD COST              0.84
WT       1.250 VOL          0.017 ECNS    0.028 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                    ECNE    0.108 NEWEL    1.000 DESRPE 0.300

MECH/STRUCT
WS        0.625 WSCF     35.920 MECID    0.000 PRODS   3.870 MCPLXS  5.520
ELECTRONICS
WE        0.625 WECF     42.258 CMPID    0.000 PRODE   4.458 MCPLXE  8.115
PWR       4.000 CMPNTS     105.                PWRFAC  1.116 CMPEFF  4.194

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.123
PRMTHS 121.000 PRMTHF 151.029 AVER. PROD RATE PER MONTH           33.302

COST RANGES             DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                      133.              680.               813.
     CENTER                    157.              844.              1002.
     TO                        192.             1091.              1284.
```

MA300 RF MOD26 DUAL FDM CPLR

INPUT DATA — PRICE 83B 6-OCT-78 13:18

QTY	11000.	PROTOS	110.0	WT	1.500	VOL	0.017	MODE	1.
QTYSYS	11.	INTEGE	0.800	INTEGS	0.400	AMULTD	150.00%	AMULTP	150.00%

MECH/STRUCT

WS	0.750	MCPLXS	5.520	PRODS	0.000	NEWST	1.000	DESRPS	2.000

ELECTRONICS

USEVOL	0.850	MCPLXE	8.176	PRODE	0.000	NEWEL	1.000	DESRPE	0.150
PWR	4.000	CMPNTS	160.	CMPID	0.000	PWRFAC	0.000	CMPEFF	0.000

ENGINEERING

ENMTHS	102.0	ENMTHP	13.0	ENMTHT	19.0	ECMPLX	1.000	PRNF	0.000

PRODUCTION

PRMTHS	121.0	PRMTHP	0.0	LCURVE	0.838	ECNE	0.000	ECNS	0.000

GLOBAL

YEAR	1978.	ESC	0.00%	PROJCT	1.000	DATA	1.000	TLGTST	1.000
PLTFM	1.800	SYSTEM	1.000	PPROJ	1.000	PDATA	1.000	PTLGTS	1.00

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	35.	5.	40.
DESIGN	111.	15.	126.
SYSTEMS	12.	0.	12.
PROJ MGMT	29.	288.	316.
DATA	8.	13.	21.
SUBTOTAL(ENG)	194.	321.	515.
MANUFACTURING			
PRODUCTION	0.	3785.	3785.
PROTOTYPE	285.	0.	285.
TOOL-TEST EQ	21.	1248.	1269.
SUBTOTAL(MFG)	307.	5033.	5340.
TOTAL COST	501.	5354.	5855.

AVCOST 0.34 — TOTAL AV PROD COST 0.49

WT	1.500	VOL	0.017	ECNS	0.040	NEWST	1.000	DESRPS	0.000
LCURVE	0.838			ECNE	0.165	NEWEL	1.000	DESRPE	0.150

MECH/STRUCT

WS	0.750	WSCF	43.103	MECID	0.000	PRODS	3.825	MCPLXS	5.520

ELECTRONICS

WE	0.750	WECF	50.710	CMPID	0.000	PRODE	4.362	MCPLXE	8.176
PWR	4.000	CMPNTS	160.			PWRFAC	1.480	CMPEFF	3.000

SCHEDULES

ENMTHS 102.000 ENMTHP 13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF 0.029

PRMTHS 121.000 PRMTHP 168.277 AVER. PROD RATE PER MONTH 232.670

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	414.	4218.	4632.
CENTER	501.	5354.	5855.
TO	633.	7137.	7770.

```
MA300 RF MOD27 STAL PWR CONV

INPUT DATA                                PRICE  836   6-OCT-78    13:20
QTY        6000. PROTOS    60.0 WT       6.000 VOL       0.174 MODE       1.
QTYSYS        6. INTEGE   0.800 INTEGS   0.400 AMULTD  150.00% AMULTP 150.00%

MECH/STRUCT
WS        4.500 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   8.073 PRODE    0.000 NEWEL     1.000 DESRPE    0.200
PWR     70.000 CMPNTS     90. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS    96.0 ENMTHP    19.0 ENMTHT    25.0 ECMPLX    1.500 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.852 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

                                          **********
WECF=    10.165 IS ABNORMAL-CHECK INPUTS
                                          **********

PROGRAM COST             DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        82.                7.               89.
 DESIGN                         299.               21.              321.
 SYSTEMS                         54.                0.               54.
 PROJ MGMT                       76.              339.              415.
 DATA                            25.               16.               40.
  SUBTOTAL(ENG)                 536.              383.              919.

MANUFACTURING
 PRODUCTION                       0.             5490.             5490.
 PROTOTYPE                      400.                0.              400.
 TOOL-TEST EQ                    38.              737.              775.
  SUBTOTAL(MFG)                 438.             6227.             6665.

  TOTAL COST                    974.             6610.             7584.

AVCOST                 0.91          TOTAL AV PROD COST              1.10
WT       6.000 VOL        0.174 ECNS     0.039 NEWST    1.000 DESRPS 0.000
LCURVE   0.852                  ECNE     0.153 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS         4.500 WSCF     25.922 MECID    0.000 PRODS  3.953 MCPLXS   5.520
ELECTRONICS
WE         1.500 WECF     10.165 CMPID    0.000 PRODE******* MCPLXE   8.073
PWR       70.000 CMPNTS      90.                PWRFAC 0.148 CMPEFF  23.985

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF      0.042
PRMTHS 121.000 PRMTHP 163.582 AVER. PROD RATE PER MONTH          140.904

COST RANGES              DEVELOPMENT        PRODUCTION        TOTAL COST
      FROM                      821.             5309.             6130.
      CENTER                    974.             6610.             7584.
      TO                       1199.             8533.             9731.
```

```
MA300 INT TEST

INPUT DATA                                PRICE  83B  6-OCT-78   13:22
QTY       1000. PROTOS   10.0 IWT     13.928 IVOL      0.169 MODE       5.
QTYSYS       1. INTEGE  0.000 INTEGS   0.000 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
IWS      2.531 MCPLXS   5.471 PRODS    0.000 NEWST     0.300 DESRPS    0.000

ELECTRONICS
I-UVOL   0.999 MCPLXE   7.692 PRODE    0.000 NEWEL     0.500 DESRPE    0.000
PWR      0.000 CMPNTS      0. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT    19.0 ECMPLX    0.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE   0.000 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS     1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	111.	18.	130.
DESIGN	364.	49.	413.
SYSTEMS	48.	0.	48.
PROJ MGMT	53.	376.	429.
DATA	18.	18.	36.
SUBTOTAL(ENG)	596.	460.	1056.
MANUFACTURING			
PRODUCTION	0.	7250.	7250.
PROTOTYPE	225.	0.	225.
TOOL-TEST EQ	20.	161.	181.
SUBTOTAL(MFG)	245.	7411.	7656.
TOTAL COST	841.	7871.	8712.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	680.	5870.	6550.
CENTER	841.	7871.	8712.
TO	1125.	11711.	12836.

```
MA300 NBSP MOD101 AN

INPUT DATA                                  PRICE  83B 11-OCT-78   10:53
QTY       2000. PROTOS   20.0 WT         1.000 VOL       0.017 MODE      1.
QTYSYS       2. INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.700 MCPLXS  5.520 PRODS     0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.800 MCPLXE  7.935 PRODE     0.000 NEWEL     1.000 DESRPE    0.000
PWR     20.000 CMPNTS     0. CMPID     0.000 PWRFAC    2.000 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE   0.862 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                       21.               2.              23.
 DESIGN                         67.               6.              73.
 SYSTEMS                         7.               0.               7.
 PROJ MGMT                       9.              33.              43.
 DATA                            3.               2.               5.
  SUBTOTAL(ENG)                107.              43.             150.

MANUFACTURING
 PRODUCTION                      0.             557.             557.
 PROTOTYPE                      26.               0.              26.
 TOOL-TEST EQ                    2.              97.              99.
  SUBTOTAL(MFG)                 28.             654.             682.

  TOTAL COST                   136.             696.             832.

AVCOST              0.28            TOTAL AV PROD COST            0.35
WT       1.000 VOL        0.017 ECNS    0.030 NEWST    1.000 DESRPS 0.000
LCURVE   0.862                  ECNE    0.110 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS       0.700 WSCF    41.176 MECID    0.000 PRODS   3.836 MCPLXS  5.520
ELECTRONICS
WE       0.300 WECF    22.059 CMPID    0.000 PRODE   4.837 MCPLXE  7.935
PWR     20.000 CMPNTS   1254.                PWRFAC 2.000 CMPEFF 57.106

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.083
PRMTHS 121.000 PRMTHP 153.515 AVER. PROD RATE PER MONTH          61.510

 OST RANGES             DEVELOPMENT       PRODUCTION       TOTAL COST
      FROM                     116.             576.             692.
      CENTER                   136.             696.             832.
      TO                       163.             866.            1029.
```

```
MA300 NBSP MOD102 DI1

INPUT DATA                                        PRICE  836 11-OCT-78   10:55
QTY      2000. PROTOS   20.0 WT        1.000 VOL       0.017 MODE       1.
QTYSYS      2. INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.700 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.900 MCPLXE   8.053 PRODE    0.000 NEWEL     1.000 DESRPE    0.000
PWR    20.000 CMPNTS      0. CMPID    0.000 PWRFAC    1.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE   0.862 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS     1.00

PROGRAM COST             DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        22.                2.               24.
 DESIGN                          69.                7.               77.
 SYSTEMS                          8.                0.                8.
 PROJ MGMT                       10.               36.               46.
 DATA                             3.                2.                5.
  SUBTOTAL(ENG)                 112.               47.              159.

MANUFACTURING
 PRODUCTION                       0.              604.              604.
 PROTOTYPE                       28.                0.               28.
 TOOL-TEST EQ                     2.              101.              104.
  SUBTOTAL(MFG)                  30.              705.              735.

  TOTAL COST                    142.              752.              894.

AVCOST                 0.30             TOTAL AV PROD COST            0.38
WT      1.000 VOL         0.017 ECNS     0.030 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                   ECNE     0.116 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS        0.700 WSCF    41.176 MECID    0.000 PRODS   3.836 MCPLXS   5.520
ELECTRONICS
WE        0.300 WECF    19.608 CMPID    0.000 PRODE   5.002 MCPLXE   8.053
PWR      20.000 CMPNTS    446.                PWRFAC 1.000 CMPEFF 49.702

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF       0.081
PRMTHS 121.000 PRMTHP 154.231 AVER. PROD RATE PER MONTH            60.184

COST RANGES              DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                       122.              623.              745.
     CENTER                     142.              752.              894.
     TO                         170.              926.             1095.
```

```
MA300 NBSP MOD103 DI12

INPUT DATA                                PRICE  83B 11-OCT-78    10:57
QTY      2000. PROTOS    20.0 WT       1.000 VOL       0.017 MODE      1.
QTYSYS      2. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.700 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.900 MCPLXE   8.053 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR     10.000 CMPNTS      0. CMPID    0.000 PWRFAC    2.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PPMTHP     0.0 LCURVE   0.862 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST               DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                          22.                2.               24.
 DESIGN                            69.                7.               77.
 SYSTEMS                            8.                0.                8.
 PROJ MGMT                         10.               36.               46.
 DATA                               3.                2.                5.
  SUBTOTAL(ENG)                   112.               47.              159.

MANUFACTURING
 PRODUCTION                         0.              604.              604.
 PROTOTYPE                         28.                0.               28.
 TOOL-TEST EQ                       2.              101.              104.
  SUBTOTAL(MFG)                    30.              705.              735.

  TOTAL COST                      142.              752.              894.

AVCOST                 0.30           TOTAL AV PROD COST              0.38
WT        1.000 VOL         0.017 ECNS    0.030 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                     ECNE    0.116 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS        0.700 WSCF     41.176 MECID    0.000 PRODS  3.836 MCPLXS  5.520
ELECTRONICS
WE        0.300 WECF     19.608 CMPID    0.000 PRODE  5.002 MCPLXE  8.053
PWR      10.000 CMPNTS     627.                PWRFAC 2.000 CMPEFF 42.763

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.081
PRMTHS 121.000 PRMTHP 154.231 AVER. PROD RATE PER MONTH          60.184

COST RANGES                DEVELOPMENT        PRODUCTION        TOTAL COST
      FROM                        122.              623.              745.
      CENTER                      142.              752.              894.
      TO                          170.              926.             1095.
```

```
MA300 WBSF MOD111 DET

INPUT DATA                                     PRICE  83B 11-OCT-78    10:59
QTY        4000. PROTOS    40.0 WT        1.000 VOL        0.017 MODE        1.
QTYSYS        4. INTEGE   0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS         0.700 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.850 MCPLXE   8.049 PRODE     0.000 NEWEL      1.000 DESRPE    0.000
PWR     20.000 CMPNTS      0. CMPID     0.000 PWRFAC     1.500 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX     1.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.856 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA       1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST           DEVELOPMENT          PRODUCTION          TOTAL COST
ENGINEERING
 DRAFTING                      22.                  2.                 24.
 DESIGN                        69.                  8.                 77.
 SYSTEMS                        8.                  0.                  8.
 PROJ MGMT                     11.                 61.                 72.
 DATA                           4.                  3.                  6.
  SUBTOTAL(ENG)               113.                 74.                188.

MANUFACTURING
 PRODUCTION                     0.                974.                974.
 PROTOTYPE                     53.                  0.                 53.
 TOOL-TEST EQ                   4.                186.                190.
  SUBTOTAL(MFG)                57.               1160.               1217.

  TOTAL COST                  170.               1235.               1405.

AVCOST                 0.24            TOTAL AV PROD COST              0.31
WT         1.000 VOL          0.017 ECNS      0.034 NEWST    1.000 DESRPS 0.000
LCURVE   0.856                      ECNE      0.132 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS         0.700 WSCF        41.176 MECID     0.000 PRODS    3.836 MCPLXS   5.520
ELECTRONICS
WE         0.300 WECF        20.761 CMPID     0.000 PRODE    4.954 MCPLXE   8.049
PWR       20.000 CMPNTS        816.                 PWRFAC 1.500 CMPEFF 53.664

SCHEDULES
ENMTHS 102.000 ENMTHP   13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF       0.054
PRMTHS 121.000 PRMTHP 158.624 AVER. PROD RATE PER MONTH             106.316

COST RANGES            DEVELOPMENT          PRODUCTION          TOTAL COST
     FROM                     145.               1020.               1165.
     CENTER                   170.               1235.               1405.
     TO                       204.               1528.               1732.
```

```
MA300 WBSP MOD112 EV DET

INPUT DATA                                    PRICE  836 11-OCT-78    11:00
QTY       1000. PROTOS    10.0 WT        1.000 VOL        0.017 MODE        1.
QTYSYS       1. INTEGE   0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        0.700 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL    0.900 MCPLXE   8.211 PRODE     0.000 NEWEL      1.000 DESRPE    0.000
PWR      20.000 CMPNTS      0. CMPID     0.000 PWRFAC     1.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX     1.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE   0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR      1978. ESC      0.00% PROJCT    1.000 DATA       1.000 TLGTST    1.000
PLTFM     1.800 SYSTEM   1.000 PPROJ     1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                         23.                2.              25.
 DESIGN                           73.                7.              81.
 SYSTEMS                           8.                0.               8.
 PROJ MGMT                         9.               25.              34.
 DATA                              3.                1.               5.
  SUBTOTAL(ENG)                  117.               36.             153.

MANUFACTURING
 PRODUCTION                        0.              451.             451.
 PROTOTYPE                        16.                0.              16.
 TOOL-TEST EQ                      2.               52.              53.
  SUBTOTAL(MFG)                   18.              503.             520.

  TOTAL COST                     135.              539.             673.

AVCOST                  0.45            TOTAL AV PROD COST            0.54
WT        1.000 VOL        0.017 ECNS      0.028 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                 ECNE      0.112 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS         0.700 WSCF     41.176 MECID     0.000 PRODS   3.836 MCPLXS  5.520
ELECTRONICS
WE         0.300 WECF     19.606 CMPID     0.000 PRODE   5.100 MCPLXE  8.211
PWR       20.000 CMPNTS     446.                 PWRFAC 1.000 CMPEFF 48.821

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.122
PRMTHS 121.000 PRMTHP 151.388 AVER. PROD RATE PER MONTH           32.907

COST RANGES               DEVELOPMENT        PRODUCTION       TOTAL COST
     FROM                        116.              447.             564.
     CENTER                      135.              539.             673.
     TO                          160.              659.             819.
```

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MA300 WBSP MOD113 SDU MEM

INPUT DATA                                   PRICE  836 11-OCT-78   11:02
QTY       1000. PROTOS   10.0 WT        1.000 VOL        0.017 MODE       1.
QTYSYS       1. INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.700 MCPLXS   5.520 PRODS     0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.900 MCPLXE   8.211 PRODE     0.000 NEWEL      1.000 DESRPE    0.000
PWR     20.000 CMPNTS      0. CMPID     0.000 PWRFAC     1.000 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT     19.0 ECMPLX     1.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHF     0.0 LCURVE    0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT    1.000 DATA       1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ     1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST               DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                          23.                2.               25.
 DESIGN                            73.                7.               81.
 SYSTEMS                            8.                0.                8.
 PROJ MGMT                          9.               25.               34.
 DATA                               3.                1.                5.
  SUBTOTAL(ENG)                   117.               36.              153.

MANUFACTURING
 PRODUCTION                         0.              451.              451.
 PROTOTYPE                         16.                0.               16.
 TOOL-TEST EQ                       2.               52.               53.
  SUBTOTAL(MFG)                    18.              503.              520.

  TOTAL COST                      135.              539.              673.

AVCOST                0.45             TOTAL AV PROD COST              0.54
WT        1.000 VOL        0.017 ECNS     0.028 NEWST    1.000 DESRPS 0.000
LCURVE  0.878                    ECNE     0.112 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS        0.700 WSCF     41.176 MECID    0.000 PRODS  3.836 MCPLXS  5.520
ELECTRONICS
WE        0.300 WECF     19.608 CMPID    0.000 PRODE  5.100 MCPLXE  8.211
PWR      20.000 CMPNTS     446.                PWRFAC 1.000 CMPEFF 48.821

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.122
PRMTHS 121.000 PRMTHF 151.388 AVER. PROD RATE PER MONTH          32.907

COST RANGES                DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                         116.              447.              564.
     CENTER                       135.              539.              673.
     TO                           160.              659.              819.
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MA300 WBSP MOD114 EV PRO

INPUT DATA                                 PRICE  838 11-OCT-78   11:04
QTY     2000. PROTOS   20.0 WT      1.000 VOL       0.017 MODE       1.
QTYSYS     2. INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.700 MCPLXS  5.520 PRODS   0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.900 MCPLXE  8.211 PRODE   0.000 NEWEL     1.000 DESRPE   0.000
PWR    20.000 CMPNTS     0. CMPID   0.000 PWRFAC    1.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.862 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                         23.                2.              25.
 DESIGN                           73.                8.              82.
 SYSTEMS                           8.                0.               8.
 PROJ MGMT                        10.               40.              50.
 DATA                              4.                2.               5.
  SUBTOTAL(ENG)                  118.               53.             171.

MANUFACTURING
 PRODUCTION                        0.              674.             674.
 PROTOTYPE                        30.                0.              30.
 TOOL-TEST EQ                      3.              108.             111.
  SUBTOTAL(MFG)                   33.              783.             816.

  TOTAL COST                     151.              836.             987.

AVCOST                0.34          TOTAL AV PROD COST              0.42
WT      1.000 VOL          0.017 ECNS    0.031 NEWST    1.000 DESRPS 0.000
LCURVE  0.862                    ECNE    0.125 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS        0.700 WSCF     41.176 MECID    0.000 PRODS  3.836 MCPLXS  5.520
ELECTRONICS
WE        0.300 WECF     19.608 CMPID    0.000 PRODE  5.100 MCPLXE  8.211
PWR      20.000 CMPNTS     446.                PWRFAC 1.000 CMPEFF 48.821

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.080
PRMTHS 121.000 PRMTHP 155.199 AVER. PROD RATE PER MONTH           58.481

COST RANGES               DEVELOPMENT        PRODUCTION       TOTAL COST
      FROM                       130.              693.             823.
      CENTER                     151.              836.             987.
      TO                         179.             1025.            1204.
```

```
MA300 WBSP MOD115 EV SCH

INPUT DATA                                PRICE  836 11-OCT-78   11:06
QTY       1000. PROTOS   10.0 WT       1.000 VOL       0.017 MODE      1.
QTYSYS       1. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.700 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.900 MCPLXE   8.211 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR     20.000 CMPNTS      0. CMPID    0.000 PWRFAC    1.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF     0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT        PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                      23.                2.              25.
 DESIGN                        73.                7.              81.
 SYSTEMS                        8.                0.               8.
 PROJ MGMT                      9.               25.              34.
 DATA                           3.                1.               5.
  SUBTOTAL(ENG)               117.               36.             153.

MANUFACTURING
 PRODUCTION                     0.              451.             451.
 PROTOTYPE                     16.                0.              16.
 TOOL-TEST EQ                   2.               52.              53.
  SUBTOTAL(MFG)                18.              503.             520.

  TOTAL COST                  135.              539.             673.

AVCOST                 0.45           TOTAL AV PROD COST           0.54
WT        1.000 VOL       0.017 ECNS     0.028 NEWST   1.000 DESRPS 0.000
LCURVE  0.878                   ECNE     0.112 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS        0.700 WSCF     41.176 MECID    0.000 PRODS   3.836 MCPLXS  5.520
ELECTRONICS
WE        0.300 WECF     19.608 CMPID    0.000 PRODE   5.100 MCPLXE  8.211
PWR      20.000 CMPNTS     446.                PWRFAC  1.000 CMPEFF 48.821

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.122
PRMTHS 121.000 PRMTHF 151.388 AVER. PROD RATE PER MONTH          32.907

COST RANGES            DEVELOPMENT        PRODUCTION       TOTAL COST
     FROM                     116.              447.             564.
     CENTER                   135.              539.             673.
     TO                       160.              659.             819.
```

```
MA300 WBSF MOD116 TRAN

INPUT DATA                                     PRICE  83B 11-OCT-78   11:08
QTY       1000. PROTOS   10.0 WT       1.000 VOL       0.017 MODE        1.
QTYSYS       1. INTEGE  0.600 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        0.700 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE    8.049 PRODE    0.000 NEWEL     1.000 DESRPE   0.000
PWR    20.000 CMPNTS       0. CMPID    0.000 PWRFAC    1.500 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP     13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF      0.0 LCURVE   0.878 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC       0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM    1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST               DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                          22.               2.              24.
 DESIGN                            69.               6.              76.
 SYSTEMS                            8.               0.               8.
 PROJ MGMT                          9.              22.              31.
 DATA                               3.               1.               4.
  SUBTOTAL(ENG)                   111.              32.             142.

MANUFACTURING
 PRODUCTION                         0.             402.             402.
 PROTOTYPE                         15.               0.              15.
 TOOL-TEST EQ                       1.              49.              50.
  SUBTOTAL(MFG)                    16.             451.             468.

  TOTAL COST                      127.             483.             610.

AVCOST                   0.40           TOTAL AV PROD COST             0.48
WT        1.000 VOL         0.017 ECNS    0.028 NEWST    1.000 DESRPS 0.000
LCURVE  0.878                     ECNE    0.104 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS        0.700 WSCF     41.176 MECID    0.000 PRODS   3.836 MCPLXS   5.520
ELECTRONICS
WE        0.300 WECF     20.761 CMPID    0.000 PRODE   4.954 MCPLXE   8.049
PWR      20.000 CMPNTS     816.                PWRFAC  1.500 CMPEFF  53.664

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF        0.125
PRMTHS 121.000 PRMTHF 150.518 AVER. PROD RATE PER MONTH             33.878

COST RANGES                DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                         109.             401.             510.
     CENTER                       127.             483.             610.
     TO                           152.             595.             747.
```

```
MA300 WBSP MOD117 RS ENDE

INPUT DATA                                   PRICE  83B 11-OCT-78   11:09
QTY      1000. PROTOS   10.0 WT        1.000 VOL        0.017 MODE       1.
QTYSYS      1. INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.700 MCPLXS  5.520 PRODS     0.000 NEWST      1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.900 MCPLXE  8.211 PRODE     0.000 NEWEL      1.000 DESRPE   0.000
PWR     20.000 CMPNTS     0. CMPID     0.000 PWRFAC     1.000 CMPEFF   0.000

ENGINEERING
ENMTHS  103.0 ENMTHP    12.0 ENMTHT    18.0 ECMPLX     0.900 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE   0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT    1.000 DATA       1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ     1.000 PDATA      1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                     21.                2.               23.
 DESIGN                       64.                7.               72.
 SYSTEMS                       6.                0.                6.
 PROJ MGMT                     9.               25.               34.
 DATA                          3.                1.                4.
  SUBTOTAL(ENG)              103.               36.              139.

MANUFACTURING
 PRODUCTION                    0.              439.              439.
 PROTOTYPE                    16.                0.               16.
 TOOL-TEST EQ                  1.               52.               53.
  SUBTOTAL(MFG)               17.              491.              508.

  TOTAL COST                 120.              526.              647.

AVCOST                  0.44           TOTAL AV PROD COST            0.53
WT       1.000 VOL          0.017 ECNS    0.028 NEWST    1.000 DESRPS 0.000
LCURVE   0.878                    ECNE    0.111 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS         0.700 WSCF     41.176 MECID    0.000 PRODS   3.836 MCPLXS  5.520
ELECTRONICS
WE         0.300 WECF     19.608 CMPID    0.000 PRODE   5.100 MCPLXE  8.211
PWR       20.000 CMPNTS    446.                 PWRFAC 1.000 CMPEFF 48.821

SCHEDULES
ENMTHS 103.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF     0.122
PRMTHS 121.000 PRMTHP 151.382 AVER. PROD RATE PER MONTH          32.914

COST RANGES            DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                    104.              437.              541.
     CENTER                  120.              526.              647.
     TO                      143.              644.              787.
```

```
MA300 CP MOD121 MASS MEM

INPUT DATA                                   PRICE  836 11-OCT-78    11:11
QTY        1000. PROTOS    10.0 WT         1.000 VOL        0.017 MODE        1.
QTYSYS        1. INTEGE   0.800 INTEGS     0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        0.700 MCPLXS    5.520 PRODS      0.000 NEWST      1.000 DESRPS    2.000

ELECTRONICS
USEVOL    0.900 MCPLXE    8.234 PRODE      0.000 NEWEL      1.000 DESRPE    0.000
PWR       5.000 CMPNTS       0. CMPID      0.000 PWRFAC     1.000 CMPEFF    0.000

ENGINEERING
ENMTHS    103.0 ENMTHP     12.0 ENMTHT      18.0 ECMPLX     0.900 PRNF      0.000

PRODUCTION
PRMTHS    121.0 PRMTHF      0.0 LCURVE     0.878 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR      1978. ESC       0.00% PROJCT     1.000 DATA       1.000 TLGTST    1.000
PLTFM     1.800 SYSTEM    1.000 PPROJ      1.000 PDATA      1.000 PTLGTS     1.00

PROGRAM COST              DEVELOPMENT         PRODUCTION         TOTAL COST
ENGINEERING
 DRAFTING                         21.                 2.                23.
 DESIGN                           65.                 8.                72.
 SYSTEMS                           6.                 0.                 6.
 PROJ MGMT                         9.                26.                34.
 DATA                              3.                 1.                 4.
  SUBTOTAL(ENG)                  104.                36.               140.

MANUFACTURING
 PRODUCTION                        0.               447.               447.
 PROTOTYPE                        16.                 0.                16.
 TOOL-TEST EQ                      1.                52.                53.
  SUBTOTAL(MFG)                   17.               499.               516.

  TOTAL COST                     121.               535.               657.

AVCOST                 0.45            TOTAL AV PROD COST            0.54
WT        1.000 VOL        0.017 ECNS     0.028 NEWST    1.000 DESRPS 0.000
LCURVE    0.878                  ECNE     0.112 NEWEL    1.000 DESRPE 0.000

MECH/STRUCT
WS         0.700 WSCF     41.176 MECID    0.000 PRODS   3.836 MCPLXS   5.520
ELECTRONICS
WE         0.300 WECF     19.608 CMPID    0.000 PRODE   5.115 MCPLXE   8.234
PWR        5.000 CMPNTS     111.                PWRFAC  1.000 CMPEFF  21.347

SCHEDULES
ENMTHS 103.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF      0.122
PRMTHS 121.000 PRMTHF 151.507 AVER. PROD RATE PER MONTH           32.780

COST RANGES               DEVELOPMENT         PRODUCTION         TOTAL COST
      FROM                       105.               445.               549.
      CENTER                     121.               535.               657.
      TO                         144.               655.               799.
```

MA300 CP MOD122 MICRO COMP

INPUT DATA PRICE 836 11-OCT-78 11:13

QTY	6000.	PROTOS	60.0	WT	1.000	VOL	0.017	MODE	1.
QTYSYS	6.	INTEGE	0.800	INTEGS	0.400	AMULTD	150.00%	AMULTP	150.00%

MECH/STRUCT

WS	0.700	MCPLXS	5.520	PRODS	0.000	NEWST	1.000	DESRPS	2.000

ELECTRONICS

USEVOL	0.850	MCPLXE	8.298	PRODE	0.000	NEWEL	1.000	DESRPE	0.000
PWR	5.000	CMPNTS	0.	CMPID	0.000	PWRFAC	1.000	CMPEFF	0.000

ENGINEERING

ENMTHS	103.0	ENMTHP	12.0	ENMTHT	18.0	ECMPLX	0.900	PRNF	0.000

PRODUCTION

PRMTHS	121.0	PRMTHP	0.0	LCURVE	0.852	ECNE	0.000	ECNS	0.000

GLOBAL

YEAR	1978.	ESC	0.00%	PROJCT	1.000	DATA	1.000	TLGTST	1.000
PLTFM	1.800	SYSTEM	1.000	PPROJ	1.000	PDATA	1.000	PTLGTS	1.00

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	21.	3.	25.
DESIGN	66.	11.	77.
SYSTEMS	6.	0.	6.
PROJ MGMT	13.	100.	113.
DATA	4.	5.	9.
SUBTOTAL(ENG)	111.	118.	229.
MANUFACTURING			
PRODUCTION	0.	1492.	1492.
PROTOTYPE	85.	0.	85.
TOOL-TEST EQ	6.	313.	320.
SUBTOTAL(MFG)	91.	1806.	1897.
TOTAL COST	202.	1924.	2126.

AVCOST 0.25 TOTAL AV PROD COST 0.32

WT	1.000	VOL	0.017	ECNS	0.037	NEWST	1.000	DESRPS	0.000
LCURVE	0.852			ECNE	0.158	NEWEL	1.000	DESRPE	0.000

MECH/STRUCT

WS	0.700	WSCF	41.176	MECID	0.000	PRODS	3.836	MCPLXS	5.520

ELECTRONICS

WE	0.300	WECF	20.761	CMPID	0.000	PRODE	5.108	MCPLXE	8.298
PWR	5.000	CMPNTS	111.			PWRFAC	1.000	CMPEFF	20.996

SCHEDULES

ENMTHS 103.000 ENMTHP 12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF 0.041

PRMTHS 121.000 PRMTHP 163.499 AVER. PROD RATE PER MONTH 141.181

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	172.	1586.	1758.
CENTER	202.	1924.	2126.
TO	242.	2369.	2611.

```
MA300 INT TEST

INPUT DATA                                    PRICE  83B 11-OCT-78    11:15
QTY      1000. PROTOS   10.0 IWT      1.167 IVOL      0.025 MODE      5.
QTYSYS      1. INTEGE  0.000 INTEGS   0.000 AMULTD  150.00% AMULTP 150.00%

MECH/STRUCT
IWS     0.373 MCPLXS   5.292 PRODS    0.000 NEWST     0.300 DESRPS    0.000

ELECTRONICS
I-UVOL  0.913 MCPLXE   7.619 PRODE    0.000 NEWEL     0.500 DESRPE    0.000
PWR     0.000 CMPNTS      0. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    0.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE   0.000 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	17.	2.	20.
DESIGN	56.	7.	64.
SYSTEMS	8.	0.	8.
PROJ MGMT	8.	33.	41.
DATA	3.	2.	4.
SUBTOTAL(ENG)	92.	45.	136.
MANUFACTURING			
PRODUCTION	0.	635.	635.
PROTOTYPE	21.	0.	21.
TOOL-TEST EQ	2.	42.	44.
SUBTOTAL(MFG)	23.	676.	700.
TOTAL COST	115.	721.	836.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	96.	567.	662.
CENTER	115.	721.	836.
TO	146.	976.	1123.

TOTAL COST, LESS INTEGRATION COST

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	264.	27.	290.
DESIGN	833.	91.	924.
SYSTEMS	87.	0.	87.
PROJ MGMT	117.	454.	571.
DATA	41.	22.	62.
SUBTOTAL(ENG)	1342.	594.	1935.
MANUFACTURING			
PRODUCTION	0.	7545.	7545.
PROTOTYPE	346.	0.	346.
TOOL-TEST EQ	29.	1216.	1244.
PURCH ITEMS	0.	0.	0.
SUBTOTAL(MFG)	374.	8761.	9135.
TOTAL COST	1716.	9355.	11071.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	1474.	7746.	9220.
CENTER	1716.	9355.	11071.
TO	2047.	11510.	13557.

TOTAL COST, WITH INTEGRATION COST

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	281.	29.	310.
DESIGN	890.	98.	988.
SYSTEMS	95.	0.	95.
PROJ MGMT	124.	488.	612.
DATA	43.	23.	66.
SUBTOTAL(ENG)	1433.	638.	2072.
MANUFACTURING			
PRODUCTION	0.	8180.	8180.
PROTOTYPE	367.	0.	367.
TOOL-TEST EQ	31.	1257.	1288.
PURCH ITEMS	0.	0.	0.
SUBTOTAL(MFG)	398.	9437.	9835.
TOTAL COST	1831.	10076.	11907.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	1570.	8313.	9883.
CENTER	1831.	10076.	11907.
TO	2193.	12486.	14680.

```
MA300 ENCLOSURE 1

INPUT DATA                              PRICE  83B  6-OCT-78   12:15
QTY      5000. PROTOS   50.0 WT        7.000 VOL       1.710 MODE      2.
QTYSYS      5. INTEGE  0.000 INTEGS    0.000 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       7.000 MCPLXS  5.520 PRODS     0.000 NEWST     1.000 DESRPS   2.000

ENGINEERING
ENMTHS   109.0 ENMTHP    6.0 ENMTHT     12.0 ECMPLX    0.500 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF    0.0 LCURVE    0.856                 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT    1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ     1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                          5.                0.                6.
 DESIGN                           12.                1.               13.
 SYSTEMS                           1.                0.                1.
 PROJ MGMT                        13.               76.               89.
 DATA                              3.                4.                7.
  SUBTOTAL(ENG)                   35.               81.              115.

MANUFACTURING
 PRODUCTION                        0.             1443.             1443.
 PROTOTYPE                        96.                0.               96.
 TOOL-TEST EQ                      3.              174.              177.
  SUBTOTAL(MFG)                   99.             1617.             1716.

  TOTAL COST                     134.             1697.             1831.

AVCOST               0.29          TOTAL AV PROD COST                0.34
WT       7.000 VOL        1.710 ECNS    0.023 NEWST    1.000 DESRPS 0.255
LCURVE   0.856
MECH/STRUCT
WS       7.000 WSCF       4.094 MECID   0.000 PRODS    4.457 MCPLXS  5.520

SCHEDULES
ENMTHS 109.000 ENMTHP   6.000 ENMTHT 12.000 ECMPLX 0.500 PRNF      0.069
PRMTHS 121.000 PRMTHF 144.512 AVER. PROD RATE PER MONTH          212.655

COST RANGES               DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                        114.             1431.             1545.
     CENTER                      134.             1697.             1831.
     TO                          162.             2069.             2230.
```

```
MA300 ENCLOSURE 2

INPUT DATA                                PRICE  83B  6-OCT-78    12:17
QTY      5000. PROTOS   50.0 WT       5.000 VOL        0.833 MODE      2.
QTYSYS      5. INTEGE  0.000 INTEGS   0.000 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       5.000 MCPLXS  5.520 PRODS    0.000 NEWST      0.300 DESRPS   2.000

ENGINEERING
ENMTHS   109.0 ENMTHP     6.0 ENMTHT   12.0 ECMPLX     0.500 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF     0.0 LCURVE  0.854                    ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT   1.000 DATA       1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA      1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	1.	0.	2.
DESIGN	3.	1.	4.
SYSTEMS	0.	0.	0.
PROJ MGMT	8.	58.	66.
DATA	2.	3.	5.
SUBTOTAL(ENG)	15.	62.	77.
MANUFACTURING			
PRODUCTION	0.	1072.	1072.
PROTOTYPE	73.	0.	73.
TOOL-TEST EQ	2.	159.	161.
SUBTOTAL(MFG)	75.	1231.	1306.
TOTAL COST	90.	1293.	1383.

```
AVCOST                0.21           TOTAL AV PROD COST            0.26
WT       5.000 VOL        0.833 ECNS    0.023 NEWST   0.300 DESRPS 0.171
LCURVE  0.854
MECH/STRUCT
WS        5.000 WSCF      6.002 MECID   0.000 PRODS  4.348 MCPLXS  5.520

SCHEDULES
ENMTHS 109.000 ENMTHP   6.000 ENMTHT 12.000 ECMPLX 0.500 PRNF    0.069
PRMTHS 121.000 PRMTHF 144.325 AVER. PROD RATE PER MONTH         214.363
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	77.	1067.	1163.
CENTER	90.	1293.	1383.
TO	109.	1589.	1698.

ARCHITECTURE FOUR

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MA400 RF MOD331 GPS DUAL RF BD

INPUT DATA                              PRICE  83B 23-OCT-78   16:31
QTY      2000. PROTOS    20.0 WT       1.250 VOL       0.017 MODE       1.
QTYSYS      2. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.750 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.650 MCPLXE   8.021 PRODE    0.000 NEWEL     1.000 DESRPE    0.400
PWR     15.000 CMPNTS    123. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS    96.0 ENMTHP    19.0 ENMTHT    25.0 ECMPLX    1.500 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.862 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                       29.                2.               31.
 DESIGN                        105.                6.              111.
 SYSTEMS                        19.                0.               19.
 PROJ MGMT                      19.               51.               70.
 DATA                            7.                2.               10.
  SUBTOTAL(ENG)                180.               61.              240.

MANUFACTURING
 PRODUCTION                      0.              871.              871.
 PROTOTYPE                      47.                0.               47.
 TOOL-TEST EQ                    5.              126.              131.
  SUBTOTAL(MFG)                 52.              998.             1050.

  TOTAL COST                   232.             1058.             1290.

AVCOST                 0.44            TOTAL AV PROD COST              0.53
WT        1.250 VOL         0.017 ECNS    0.031 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                     ECNE    0.119 NEWEL   1.000 DESRPE 0.400

MECH/STRUCT
WS        0.750 WSCF     44.118 MECID    0.000 PRODS   3.819 MCPLXS   5.520
ELECTRONICS
WE        0.500 WECF     34.602 CMPID    0.000 PRODE   4.550 MCPLXE   8.021
PWR      15.000 CMPNTS     123.                PWRFAC 0.512 CMPEFF  27.624

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF     0.082
PRMTHS 121.000 PRMTHP 154.250 AVER. PROD RATE PER MONTH          60.150

COST RANGES             DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                      197.              858.             1055.
     CENTER                    232.             1058.             1290.
     TO                        284.             1354.             1638.
```

```
MA400 RF MOD332 STUHF RF BD

INPUT DATA                                  PRICE  83B 23-OCT-78   18:33
QTY       4000. PROTOS   40.0 WT       1.250 VOL       0.017 MODE       1.
QTYSYS       4. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        0.750 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.021 PRODE    0.000 NEWEL     1.000 DESRPE   0.400
PWR    15.000 CMPNTS   123. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   96.0 ENMTHP   19.0 ENMTHT   25.0 ECMPLX    1.500 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.856 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST             DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        29.                2.               31.
 DESIGN                         105.                6.              111.
 SYSTEMS                         19.                0.               19.
 PROJ MGMT                       23.               87.              110.
 DATA                             8.                4.               12.
  SUBTOTAL(ENG)                 184.              100.              283.

MANUFACTURING
 PRODUCTION                       0.             1409.             1409.
 PROTOTYPE                       89.                0.               89.
 TOOL-TEST EQ                     9.              240.              249.
  SUBTOTAL(MFG)                  98.             1650.             1748.

  TOTAL COST                    282.             1749.             2031.

AVCOST               0.35         TOTAL AV PROD COST              0.44
WT        1.250 VOL        0.017 ECNS     0.035 NEWST    1.000 DESRPS 0.000
LCURVE  0.856                    ECNE     0.136 NEWEL    1.000 DESRPE 0.400

MECH/STRUCT
WS        0.750 WSCF     44.118 MECID    0.000 PRODS  3.819 MCPLXS  5.520
ELECTRONICS
WE        0.500 WECF     34.602 CMPID    0.000 PRODE  4.550 MCPLXE  8.021
PWR      15.000 CMPNTS    123.                 PWRFAC 0.512 CMPEFF 27.624

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF     0.054
PRMTHS 121.000 PRMTHP 158.661 AVER. PROD RATE PER MONTH         106.154

COST RANGES              DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                        238.             1416.             1653.
     CENTER                      282.             1749.             2031.
     TO                          346.             2243.             2589.
```

```
MA400 RF MOD 333 VHFAM DUAL RF BD

INPUT DATA                                   PRICE  33B 23-OCT-78   18:34
QTY      4000. PROTOS    40.0 WT       1.250 VOL       0.017 MODE       1.
QTYSYS      4. INTEGE   0.600 INTEGS   0.400 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS      0.750 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.650 MCPLXE  8.021 PRODE    0.000 NEWEL     1.000 DESRPE    0.400
PWR    15.000 CMPNTS   123. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   96.0 ENMTHP   19.0 ENMTHT   25.0 ECMPLX    1.500 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE   0.856 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST               DEVELOPMENT         PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                          29.                 2.               31.
 DESIGN                           105.                 6.              111.
 SYSTEMS                           19.                 0.               19.
 PROJ MGMT                         23.                87.              110.
 DATA                               8.                 4.               12.
  SUBTOTAL(ENG)                   184.               100.              283.

MANUFACTURING
 PRODUCTION                         0.              1409.             1409.
 PROTOTYPE                         89.                 0.               89.
 TOOL-TEST EQ                       9.               240.              249.
  SUBTOTAL(MFG)                    98.              1650.             1748.

  TOTAL COST                      282.              1749.             2031.

AVCOST              0.35             TOTAL AV PROD COST              0.44
WT        1.250 VOL       0.017 ECNS   0.035 NEWST   1.000 DESRPS 0.000
LCURVE  0.856                   ECNE   0.136 NEWEL   1.000 DESRPE 0.400

MECH/STRUCT
WS        0.750 WSCF    44.118 MECID   0.000 PRODS  3.819 MCPLXS  5.520
ELECTRONICS
WE        0.500 WECF    34.602 CMPID   0.000 PRODE  4.550 MCPLXE  8.021
PWR      15.000 CMPNTS    123.               PWRFAC 0.512 CMPEFF 37.624

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF      0.054
PRMTHS 121.000 PRMTHP 158.661 AVER. PROD RATE PER MONTH          106.154

COST RANGES                DEVELOPMENT         PRODUCTION        TOTAL COST
     FROM                         238.              1416.             1653.
     CENTER                       282.              1749.             2031.
     TO                           346.              2243.             2589.
```

AD-A082 956 GENERAL DYNAMICS SAN DIEGO CALIF ELECTRONICS DIV F/G 17/2.1
MULTIFUNCTION MULTIBAND AIRBORNE RADIO SYSTEM MFBARS.(U)
OCT 78 F33615-78-C-1517
UNCLASSIFIED R-78-055 NL

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A082956

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MA400 RF MOD 334 VHFFM DUAL RF BD

INPUT DATA                                PRICE  836 23-OCT-78   16:36
QTY     2000. PROTOS   20.0 WT      1.250 VOL      0.017 MODE      1.
QTYSYS     2. INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.750 MCPLXS  5.520 PRODS   0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.021 PRODE   0.000 NEWEL    1.000 DESRPE   0.400
PWR    15.000 CMPNTS   123. CMPID   0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   96.0 ENMTHP   19.0 ENMTHT   25.0 ECMPLX   1.500 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF    0.0 LCURVE  0.862 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                      29.                2.               31.
 DESIGN                       105.                6.              111.
 SYSTEMS                       19.                0.               19.
 PROJ MGMT                     19.               51.               70.
 DATA                           7.                2.               10.
  SUBTOTAL(ENG)               180.               61.              240.

MANUFACTURING
 PRODUCTION                     0.              871.              871.
 PROTOTYPE                     47.                0.               47.
 TOOL-TEST EQ                   5.              126.              131.
  SUBTOTAL(MFG)                52.              998.             1050.

  TOTAL COST                  232.             1058.             1290.

AVCOST              0.44          TOTAL AV PROD COST             0.53
WT      1.250 VOL        0.017 ECNS    0.031 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                  ECNE    0.119 NEWEL   1.000 DESRPE 0.400

MECH/STRUCT
WS       0.750 WSCF    44.118 MECID   0.000 PRODS  3.819 MCPLXS  5.520
ELECTRONICS
WE       0.500 WECF    34.602 CMPID   0.000 PRODE  4.550 MCPLXE  8.021
PWR     15.000 CMPNTS   123.                PWRFAC 0.512 CMPEFF 27.624

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF    0.082
PRMTHS 121.000 PRMTHF 154.250 AVER. PROD RATE PER MONTH         60.150

COST RANGES            DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                     197.              858.             1055.
     CENTER                   232.             1058.             1290.
     TO                       284.             1354.             1638.
```

MA400 RF MOD335 HF DUAL RF 6D

```
INPUT DATA                                PRICE  836 23-OCT-76   16:36
QTY      2000. PROTOS   20.0 WT       1.250 VOL      0.017 MODE      1.
QTYSYS      2. INTEGE  0.600 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.750 MCPLXS  5.520 PRODS    0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.650 MCPLXE  8.021 PRODE    0.000 NEWEL    1.000 DESRPE   0.400
PWR     15.000 CMPNTS   123. CMPID    0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    96.0 ENMTHP   19.0 ENMTHT    25.0 ECMPLX   1.500 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE   0.862 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR     1976. ESC     0.00% PROJCT   1.000 DATA     1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROU    1.000 PDATA    1.000 PTLGTS    1.00

PROGRAM COST          DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                     29.               2.              31.
 DESIGN                      105.               6.             111.
 SYSTEMS                      19.               0.              19.
 PROJ MGMT                    19.              51.              70.
 DATA                          7.               2.              10.
  SUBTOTAL(ENG)              180.              61.             240.

MANUFACTURING
 PRODUCTION                    0.             871.             871.
 PROTOTYPE                    47.               0.              47.
 TOOL-TEST EQ                  5.             126.             131.
  SUBTOTAL(MFG)               52.             998.            1050.

  TOTAL COST                 232.            1058.            1290.

AVCOST             0.44         TOTAL AV PROD COST             0.53
WT       1.250 VOL        0.017 ECNS    0.031 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                   ECNE    0.119 NEWEL   1.000 DESRPE 0.400

MECH/STRUCT
WS       0.750 WSCF     44.116 MECID    0.000 PRODS  3.819 MCPLXS  5.520
ELECTRONICS
WE       0.500 WECF     34.602 CMPID    0.000 PRODE  4.550 MCPLXE  8.021
PWR     15.000 CMPNTS    123.                PWRFAC 0.512 CMPEFF 27.624

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF     0.082
PRMTHS 121.000 PRMTHP 154.250 AVER. PROD RATE PER MONTH          60.150

COST RANGES           DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                    197.             858.            1055.
     CENTER                  232.            1058.            1290.
     TO                      264.            1354.            1636.
```

```
MA400 RF MOD336 L DUAL RF 60

INPUT DATA                                  PRICE  836 23-OCT-78   18:40
QTY      1000. PROTOS   10.0 WT       1.250 VOL        0.017 MODE       1.
QTYSYS      1. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.750 MCPLXS  5.520 PRODS    0.000 NEWST      1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.021 PRODE    0.000 NEWEL      1.000 DESRPE   0.400
PWR    15.000 CMPNTS   123. CMPID    0.000 PWRFAC     0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   96.0 ENMTHP   19.0 ENMTHT   25.0 ECMPLX      1.500 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF    0.0 LCURVE  0.878 ECNE        0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT  1.000 DATA        1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ   1.000 PDATA       1.000 PTLGTS   1.00

PROGRAM COST          DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                     29.                2.               31.
 DESIGN                      105.                5.              110.
 SYSTEMS                      19.                0.               19.
 PROJ MGMT                    18.               32.               50.
 DATA                          7.                2.                8.
  SUBTOTAL(ENG)              178.               40.              218.

MANUFACTURING
 PRODUCTION                    0.              583.              583.
 PROTOTYPE                    25.                0.               25.
 TOOL-TEST EQ                  3.               59.               62.
  SUBTOTAL(MFG)               28.              642.              670.

  TOTAL COST                 206.              682.              888.

AVCOST                0.56              TOTAL AV PROD COST            0.68
WT       1.250 VOL        0.017 ECNS    0.028 NEWST    1.000 DESRPS 0.000
LCURVE  0.878                 ECNE    0.107 NEWEL    1.000 DESRPE 0.400

MECH/STRUCT
WS        0.750 WSCF     44.118 MECID    0.000 PRODS  3.819 MCPLXS  5.520
ELECTRONICS
WE        0.500 WECF     34.602 CMPID    0.000 PRODE  4.550 MCPLXE  8.021
PWR      15.000 CMPNTS    123.                PWRFAC 0.512 CMPEFF 27.624

SCHEDULES
ENMTHS  96.000 ENMTHP  19.000 ENMTHT 25.000 ECMPLX 1.500 PRNF      0.125
PRMTHS 121.000 PRMTHF 150.549 AVER. PROD RATE PER MONTH          33.842

COST RANGES           DEVELOPMENT        PRODUCTION        TOTAL COST
      FROM                   175.              554.              729.
      CENTER                 206.              682.              888.
      TO                     251.              870.             1121.
```

ARCHITECTURE SIX

MA600 RF MOD12 L PREAMP WIDE

```
INPUT DATA                                PRICE  83B  4-OCT-78   13:19
QTY      3000. PROTOS   30.0 WT       1.500 VOL      0.009 MODE       1.
QTYSYS      3. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.700 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE   8.020 PRODE    0.000 NEWEL     1.000 DESRPE   0.850
PWR     3.000 CMPNTS     53. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE   0.856 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

                                     **********
WECF=   104.575 IS ABNORMAL-CHECK INPUTS
                                     **********
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	9.	1.	10.
DESIGN	30.	2.	32.
SYSTEMS	3.	0.	3.
PROJ MGMT	8.	97.	105.
DATA	2.	5.	7.
SUBTOTAL(ENG)	52.	105.	157.
MANUFACTURING			
PRODUCTION	0.	1641.	1641.
PROTOTYPE	81.	0.	81.
TOOL-TEST EQ	6.	235.	242.
SUBTOTAL(MFG)	88.	1876.	1964.
TOTAL COST	140.	1981.	2121.

```
AVCOST                 0.55          TOTAL AV PROD COST          0.66
WT      1.500 VOL         0.009 ECNS    0.033 NEWST   1.000 DESRPS 0.000
LCURVE  0.856                   ECNE    0.125 NEWEL   1.000 DESRPE 0.850

MECH/STRUCT
WS        0.700 WSCF     77.778 MECID   0.000 PRODS  3.681 MCPLXS   5.520
ELECTRONICS
WE        0.800 WECF    104.575 CMPID   0.000 PRODE******* MCPLXE   8.020
PWR       3.000 CMPNTS      53.               PWRFAC 0.856 CMPEFF  -6.394

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.064
PRMTHS 121.000 PRMTHP 156.855 AVER; PROD RATE PER MONTH           83.670
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	116.	1595.	1711.
CENTER	140.	1981.	2121.
TO	176.	2554.	2730.

MA600 RF MOD13 UHF PREAMP

```
INPUT DATA                                   PRICE  838  4-OCT-78    13:20
QTY      1000.  PROTOS   10.0 WT        1.500 VOL        0.017 MODE       1.
QTYSYS      1.  INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.100 MCPLXS  5.520 PRODS     0.000 NEWST      1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE  8.075 PRODE     0.000 NEWEL      1.000 DESRPE   0.800
PWR      3.500 CMPNTS   179. CMPID     0.000 PWRFAC     0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT    19.0 ECMPLX      1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE   0.878 ECNE        0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT   1.000 DATA        1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA       1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	9.	1.	10.
DESIGN	30.	2.	32.
SYSTEMS	3.	0.	3.
PROJ MGMT	5.	28.	33.
DATA	2.	1.	3.
SUBTOTAL(ENG)	49.	32.	81.
MANUFACTURING			
PRODUCTION	0.	540.	540.
PROTOTYPE	20.	0.	20.
TOOL-TEST EQ	2.	42.	44.
SUBTOTAL(MFG)	22.	582.	604.
TOTAL COST	71.	614.	684.

```
AVCOST                 0.54          TOTAL AV PROD COST             0.61
WT       1.500 VOL          0.017 ECNS    0.028 NEWST   1.000 DESRPS 0.000
LCURVE   0.878                    ECNE    0.106 NEWEL   1.000 DESRPE 0.800

MECH/STRUCT
WS        1.100 WSCF    64.706 MECID    0.000 PRODS   3.725 MCPLXS   5.520
ELECTRONICS
WE        0.400 WECF    27.682 CMPID    0.000 PRODE   4.747 MCPLXE   8.075
PWR       3.500 CMPNTS    179.                 PWRFAC 1.745 CMPEFF  14.930

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.124
PRMTHS 121.000 PRMTHP 150.898 AVER. PROD RATE PER MONTH          33.447
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	60.	501.	561.
CENTER	71.	614.	684.
TO	87.	776.	863.

```
MA600 RF MOD 14 L PREAMP NARROW

INPUT DATA                                PRICE  83B  4-OCT-78   13:22
QTY       2000. PROTOS   20.0 WT       1.500 VOL       0.017 MODE        1.
QTYSYS       2. INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS        0.600 MCPLXS  5.520 PRODS   0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  6.021 PRODE   0.000 NEWEL     1.000 DESRPE    0.800
PWR     3.500 CMPNTS   168. CMPID   0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX    1.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHF    0.0 LCURVE  0.862 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC     0.00% PROUCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM  1.000 PPROU   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT      PRODUCTION      TOTAL COST
ENGINEERING
 DRAFTING                      12.              1.             13.
 DESIGN                        37.              3.             40.
 SYSTEMS                        4.              0.              4.
 PROJ MGMT                      8.             78.             86.
 DATA                           2.              4.              6.
  SUBTOTAL(ENG)                62.             86.            148.

MANUFACTURING
 PRODUCTION                     0.           1344.           1344.
 PROTOTYPE                     61.              0.             61.
 TOOL-TEST EQ                   5.            170.            175.
  SUBTOTAL(MFG)                66.           1514.           1580.

  TOTAL COST                  128.           1600.           1728.

AVCOST               0.67          TOTAL AV PROD COST          0.80
WT       1.500 VOL        0.017 ECNS    0.030 NEWST   1.000 DESRPS 0.000
LCURVE  0.862                  ECNE    0.116 NEWEL   1.000 DESRPE 0.800

MECH/STRUCT
WS        0,600 WSCF    35.294 MECID   0.000 PRODS  3.875 MCPLXS  5.520
ELECTRONICS
WE        0.900 WECF    62.284 CMPID   0.000 PRODE  4.141 MCPLXE  6.021
PWR       3.500 CMPNTS    168.                PWRFAC 1.672 CMPEFF -1.175

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.082
PRMTHS 121.000 PRMTHF 154.360 AVER. PROD RATE PER MONTH          59.951

COST RANGES            DEVELOPMENT      PRODUCTION      TOTAL COST
     FROM                     105.           1260.           1366.
     CENTER                   128.           1600.           1728.
     TO                       164.           2161.           2325.
```

```
MA600 RF MOD42 HF RT

INPUT DATA                                  PRICE  636   4-OCT-78    13:24
QTY       1000. PROTOS    10.0 WT      12.000 VOL       0.067 MODE       1.
QTYSYS       1. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      11.500 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.600 MCPLXE   8.233 PRODE    0.000 NEWEL     1.000 DESRPE    0.300
PWR    110.000 CMPNTS    152. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP     0.0 LCURVE   0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROUCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROU    1.000 PDATA     1.000 PTLGTS    1.00


PROGRAM COST           DEVELOPMENT         PRODUCTION         TOTAL COST
ENGINEERING
 DRAFTING                      33.                 3.                35.
 DESIGN                       105.                 8.               113.
 SYSTEMS                       11.                 0.                11.
 PROJ MGMT                     15.                71.                86.
 DATA                           5.                 3.                 9.
  SUBTOTAL(ENG)               170.                84.               255.

MANUFACTURING
 PRODUCTION                     0.              1340.              1340.
 PROTOTYPE                     60.                 0.                60.
 TOOL-TEST EQ                   6.                54.                60.
  SUBTOTAL(MFG)                66.              1395.              1461.

  TOTAL COST                  236.              1479.              1716.

AVCOST                  1.34          TOTAL AV PROD COST            1.48
WT      12.000 VOL          0.067 ECNS     0.029 NEWST   1.000 DESRPS 0.231
LCURVE  0.878                     ECNE     0.117 NEWEL   1.000 DESRPE 0.300

MECH/STRUCT
WS       11.500 WSCF    132.184 MECID    0.000 PRODS******* MCPLXS   5.520
ELECTRONICS
WE        0.500 WECF      9.579 CMPID    0.000 PRODE******* MCPLXE   8.233
PWR     110.000 CMPNTS     152.                PWRFAC 0.155 CMPEFF  54.152

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.122
PRMTHS 121.000 PRMTHP 153.028 AVER. PROD RATE PER MONTH          31.223

COST RANGES            DEVELOPMENT         PRODUCTION         TOTAL COST
     FROM                     201.              1215.              1417.
     CENTER                   236.              1479.              1716.
     TO                       286.              1862.              2148.
```

```
MA600 RF MOD61 UHF L MULTI

INPUT DATA                                  PRICE  83B  4-OCT-78   13:26
QTY      2000. PROTOS   20.0 WT        3.000 VOL       0.052 MODE      1.
QTYSYS      2. INTEGE  0.800 INTEGS    0.400 AMULTD  150.00% AMULTP 150.00%

MECH/STRUCT
WS       2.800 MCPLXS  5.520 PRODS     0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.800 MCPLXE  8.211 PRODE     0.000 NEWEL     1.000 DESRPE   0.600
PWR      0.010 CMPNTS   220. CMPID     0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    95.0 ENMTHP   20.0 ENMTHT     26.0 ECMPLX    1.500 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF    0.0 LCURVE    0.862 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PRDUCT    1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROD     1.000 PDATA     1.000 PTLGTS    1.00

                                        **********
WECF=     4.808 IS ABNORMAL-CHECK INPUTS
                                        **********

PROGRAM COST             DEVELOPMENT       PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                        22.                1.               23.
 DESIGN                          80.                3.               83.
 SYSTEMS                         14.                0.               14.
 PROJ MGMT                       15.               42.               57.
 DATA                             5.                2.                7.
  SUBTOTAL(ENG)                 137.               48.              185.

MANUFACTURING
 PRODUCTION                       0.              751.              751.
 PROTOTYPE                       47.                0.               47.
 TOOL-TEST EQ                     5.               72.               77.
  SUBTOTAL(MFG)                  53.              823.              876.

  TOTAL COST                    189.              872.             1061.

AVCOST                 0.38            TOTAL AV PROD COST            0.44
WT       3.000 VOL        0.052 ECNS     0.033 NEWST   1.000 DESRPS 0.000
LCURVE   0.862                  ECNE     0.131 NEWEL   1.000 DESRPE 0.600

MECH/STRUCT
WS        2.800 WSCF     53.846 MECID    0.000 PRODS   3.770 MCPLXS   5.520
ELECTRONICS
WE        0.200 WECF      4.808 CMPID    0.000 PRODE******* MCPLXE   8.211
PWR       0.010 CMPNTS     220.                PWRFAC****** CMPEFF=46.235

SCHEDULES
ENMTHS  95.000 ENMTHP  20.000 ENMTHT 26.000 ECMPLX 1.500 PRNF      0.080
PRMTHS 121.000 PRMTHF 156.009 AVERS PROD RATE PER MONTH          57.137

COST RANGES              DEVELOPMENT       PRODUCTION        TOTAL COST
     FROM                       160.              709.              869.
     CENTER                     189.              872.             1061.
     TO                         235.             1124.             1359.
```

MA600 RF MOD62 UHF L DIPL

```
INPUT DATA                               PRICE  63B  4-OCT-78   13:28
QTY       2000. PROTOS   20.0 WT       1.000 VOL       0.009 MODE      1.
QTYSYS       2. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.900 MCPLXS   5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL   0.800 MCPLXE   6.211 PRODE    0.000 NEWEL     1.000 DESRPE    0.200
PWR      0.010 CMPNTS     20. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT   19.0 ECMPLX     1.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE  0.862 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR     1976. ESC      0.00% PROJCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

                                        **********
WECF=    13.669 IS ABNORMAL-CHECK INPUTS
                                        **********
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	14.	1.	15.
DESIGN	44.	4.	47.
SYSTEMS	5.	0.	5.
PROJ MGMT	6.	23.	28.
DATA	2.	1.	3.
SUBTOTAL(ENG)	70.	29.	99.
MANUFACTURING			
PRODUCTION	0.	353.	353.
PROTOTYPE	17.	0.	17.
TOOL-TEST EQ	2.	79.	80.
SUBTOTAL(MFG)	19.	432.	451.
TOTAL COST	89.	461.	549.

```
AVCOST                  0.18         TOTAL AV PROD COST               0.23
WT       1.000 VOL         0.009 ECNS     0.031 NEWST    1.000 DESRPS 0.000
LCURVE   0.862                   ECNE     0.124 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS         0.900 WSCF    100.000 MECID    0.000 PRODS   3.621 MCPLXS   5.520
ELECTRONICS
WE         0.100 WECF     13.669 CMPID    0.000 PRODE******* MCPLXE   6.211
PWR        0.010 CMPNTS     20.                 PWRFAC20.352 CMPEFF-50.171

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.080
PRMTHS 121.000 PRMTHP 155.147 AVERG PROD RATE PER MONTH          58.570
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	75.	378.	453.
CENTER	89.	461.	549.
TO	109.	591.	700.

MA600 INT TEST

INPUT DATA					PRICE 836	4-OCT-78	13:30		
QTY	1000.	PROTOS	10.0	IWT	1.143	IVOL	0.035	MODE	5.
QTYSYS	1.	INTEGE	0.000	INTEGS	0.000	AMULTD	150.00%	AMULTP	150.00%
MECH/STRUCT									
IWS	0.520	MCPLXS	5.075	PRODS	0.000	NEWST	0.300	DESRPS	0.000
ELECTRONICS									
I-UVOL	0.513	MCPLXE	7.432	PRODE	0.000	NEWEL	0.500	DESRPE	0.000
PWR	0.000	CMPNTS	0.	CMPID	0.000	PWRFAC	0.000	CMPEFF	0.000
ENGINEERING									
ENMTHS	102.0	ENMTHP	13.0	ENMTHT	19.0	ECMPLX	0.000	PRNF	0.000
PRODUCTION									
PRMTHS	121.0	PRMTHP	0.0	LCURVE	0.000	ECNE	0.000	ECNS	0.000
GLOBAL									
YEAR	1978.	ESC	0.00%	PROJCT	1.000	DATA	1.000	TLGTST	1.000
PLTFM	1.800	SYSTEM	1.000	PPROJ	1.000	PDATA	1.000	PTLGTS	1.00

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	15.	2.	17.
DESIGN	50.	6.	56.
SYSTEMS	7.	0.	7.
PROJ MGMT	7.	25.	32.
DATA	2.	1.	4.
SUBTOTAL(ENG)	82.	33.	115.
MANUFACTURING			
PRODUCTION	0.	471.	471.
PROTOTYPE	16.	0.	16.
TOOL-TEST EQ	2.	31.	33.
SUBTOTAL(MFG)	18.	502.	520.
TOTAL COST	100.	536.	635.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	82.	422.	504.
CENTER	100.	536.	635.
TO	127.	729.	857.

```
MA600 RF MOD11 VHF UHF PREAMP

INPUT DATA                                PRICE  83B  4-OCT-78   12:30
QTY      3000. PROTOS   30.0 WT        2.000 VOL      0.017 MODE      1.
QTYSYS      3. INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.000 MCPLXS  5.520 PRODS     0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE  8.075 PRODE     0.000 NEWEL    1.000 DESRPE   0.200
PWR      3.500 CMPNTS   154. CMPID     0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT     19.0 ECMPLX   1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE    0.858 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT    1.000 DATA     1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ     1.000 PDATA    1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                         41.               5.              46.
 DESIGN                          131.              13.             144.
 SYSTEMS                          14.               0.              14.
 PROJ MGMT                        21.             128.             149.
 DATA                              7.               6.              13.
  SUBTOTAL(ENG)                  214.             152.             366.

MANUFACTURING
 PRODUCTION                        0.            2102.            2102.
 PROTOTYPE                       104.               0.             104.
 TOOL-TEST EQ                      8.             286.             295.
  SUBTOTAL(MFG)                  112.            2389.            2501.

  TOTAL COST                     326.            2540.            2866.

AVCOST                0.70          TOTAL AV PROD COST             0.85
WT       2.000 VOL        0.017 ECNS     0.033 NEWST    1.000 DESRPS 0.000
LCURVE   0.858                  ECNE     0.128 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS         1.000 WSCF    58.824 MECID    0.000 PRODS  3.748 MCPLXS  5.520
ELECTRONICS
WE         1.000 WECF    69.204 CMPID    0.000 PRODE  4.099 MCPLXE  8.075
PWR        3.500 CMPNTS    154.                PWRFAC 1.578 CMPEFF -4.125

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.064
PRMTHS 121.000 PRMTHP 157.452 AVER. PROD RATE PER MONTH          82.301

COST RANGES               DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                        271.            1990.            2261.
     CENTER                      326.            2540.            2866.
     TO                          415.            3468.            3882.
```

```
MA600 RF MOD21 MUBD DOWN CONV

INPUT DATA                                  PRICE  83B  4-OCT-78   12:32
QTY     17000. PROTOS  170.0 WT       2.500 VOL       0.026 MODE       1.
QTYSYS     17. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE  8.075 PRODE    0.000 NEWEL     1.000 DESRPE   0.200
PWR      5.000 CMPNTS   141. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT    19.0 ECMPLX    1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE   0.834 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT        PRODUCTION         TOTAL COST
ENGINEERING
 DRAFTING                      50.                8.                58.
 DESIGN                       159.               21.               180.
 SYSTEMS                       17.                0.                17.
 PROJ MGMT                     58.              677.               735.
 DATA                          15.               31.                46.
  SUBTOTAL(ENG)               299.              737.              1036.

MANUFACTURING
 PRODUCTION                     0.             8231.              8231.
 PROTOTYPE                    715.                0.               715.
 TOOL-TEST EQ                  52.             3220.              3272.
  SUBTOTAL(MFG)               768.            11451.             12218.

  TOTAL COST                 1067.            12187.             13254.

AVCOST                0.48           TOTAL AV PROD COST              0.72
WT       2.500 VOL        0.026 ECNS    0.043 NEWST    1.000 DESRPS 0.000
LCURVE   0.834                  ECNE    0.171 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS        1.000 WSCF    38.462 MECID    0.000 PRODS   3.853 MCPLXS   5.520
ELECTRONICS
WE        1.500 WECF    67.873 CMPID    0.000 PRODE   4.112 MCPLXE   8.075
PWR       5.000 CMPNTS    141.                PWRFAC  1.171 CMPEFF  -7.983

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF       0.023
PRMTHS 121.000 PRMTHP 172.311 AVER. PROD RATE PER MONTH           331.312

COST RANGES           DEVELOPMENT        PRODUCTION          TOTAL COST
     FROM                    865.             9387.              10252.
     CENTER                 1067.            12187.              13254.
     TO                     1395.            16964.              18359.
```

```
MA600 RF MOD31 MUBD EX

INPUT DATA                                PRICE  83B  4-OCT-78   12:33
QTY       3000. PROTOS   30.0 WT      2.000 VOL      0.026 MODE      1.
QTYSYS       3. INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        1.000 MCPLXS  5.520 PRODS   0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.075 PRODE   0.000 NEWEL    1.000 DESRPE   0.200
PWR     4.500 CMPNTS   157. CMPID   0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX   1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF    0.0 LCURVE  0.858 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROUCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROU   1.000 PDATA    1.000 PTLGTS   1.00

PROGRAM COST           DEVELOPMENT      PRODUCTION      TOTAL COST
ENGINEERING
 DRAFTING                      39.              4.             43.
 DESIGN                       123.             13.            136.
 SYSTEMS                       13.              0.             13.
 PROJ MGMT                     20.            127.            147.
 DATA                           7.              6.             12.
  SUBTOTAL(ENG)               201.            150.            351.

MANUFACTURING
 PRODUCTION                     0.           2102.           2102.
 PROTOTYPE                    104.              0.            104.
 TOOL-TEST EQ                   8.            285.            293.
  SUBTOTAL(MFG)               112.           2387.           2499.

  TOTAL COST                  313.           2537.           2850.

AVCOST              0.70          TOTAL AV PROD COST           0.85
WT       2.000 VOL        0.026 ECNS   0.033 NEWST   1.000 DESRPS 0.000
LCURVE   0.858                  ECNE   0.128 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS        1.000 WSCF    38.462 MECID   0.000 PRODS  3.853 MCPLXS  5.520
ELECTRONICS
WE        1.000 WECF    45.249 CMPID   0.000 PRODE  4.388 MCPLXE  8.075
PWR       4.500 CMPNTS    157.                PWRFAC 1.351 CMPEFF -0.677

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.064
PRMTHS 121.000 PRMTHF 157.452 AVER. PROD RATE PER MONTH          82.301

COST RANGES            DEVELOPMENT      PRODUCTION      TOTAL COST
     FROM                     263.           2023.           2286.
     CENTER                   313.           2537.           2850.
     TO                       369.           3326.           3715.
```

```
MA600 RF MOD41 VHF UHF PWR AMP

                                             PRICE  83B  4-OCT-78   12:35
INPUT DATA
QTY      2000. PROTOS   20.0 WT       5.000 VOL      0.069 MODE      1.
QTYSYS      2. INTEGE   0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      4.000 MCPLXS   5.520 PRODS    0.000 NEWST    1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.600 MCPLXE   8.231 PRODE    0.000 NEWEL    1.000 DESRPE   0.100
PWR    25.000 CMPNTS    223. CMPID    0.000 PWRFAC   0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX   1.000 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE  0.862 ECNE     0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ   1.000 PDATA    1.000 PTLGTS   1.00

PROGRAM COST           DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                      51.               5.              56.
 DESIGN                       162.              18.             179.
 SYSTEMS                       17.               0.              17.
 PROJ MGMT                     24.             119.             143.
 DATA                           8.               6.              14.
  SUBTOTAL(ENG)               261.             147.             409.

MANUFACTURING
 PRODUCTION                     0.            2111.            2111.
 PROTOTYPE                     99.               0.              99.
 TOOL-TEST EQ                   8.             188.             196.
  SUBTOTAL(MFG)               107.            2299.            2406.

  TOTAL COST                  368.            2446.            2815.

AVCOST                1.06           TOTAL AV PROD COST          1.22
WT       5.000 VOL          0.069 ECNS    0.032 NEWST   1.000 DESRPS 0.000
LCURVE   0.862                    ECNE    0.129 NEWEL   1.000 DESRPE 0.100

MECH/STRUCT
WS        4.000 WSCF     57.971 MECID    0.000 PRODS  3.752 MCPLXS  5.520
ELECTRONICS
WE        1.000 WECF     24.155 CMPID    0.000 PRODE  4.945 MCPLXE  8.231
PWR      25.000 CMPNTS     223.                PWRFAC 0.542 CMPEFF 23.403

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF     0.079
PRMTHS 121.000 PRMTHP 156.527 AVER. PROD RATE PER MONTH          56.296

COST RANGES            DEVELOPMENT       PRODUCTION       TOTAL COST
      FROM                    314.            1994.            2308.
      CENTER                  366.            2446.            2815.
      TO                      444.            3077.            3521.
```

MA600 RF MOD43 L PWR AMP .

```
INPUT DATA                                  PRICE  636   4-OCT-78    12:37
QTY      1000. PROTOS    10.0 WT       11.000 VOL       0.067 MODE       1.
QTYSYS      1.  INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       9.500 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.500 MCPLXE  6.177 PRODE    0.000 NEWEL     1.000 DESRPE   0.100
PWR    100.000 CMPNTS   235. CMPID    0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    95.0 ENMTHP   20.0 ENMTHT    26.0 ECMPLX    1.500 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHF    0.0 LCURVE   0.676 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PRDUCT   1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.600 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

                                     **********
WSCF=    109.195 IS ABNORMAL-CHECK INPUTS
                                     **********
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	101.	6.	107.
DESIGN	365.	20.	386.
SYSTEMS	65.	0.	65.
PROJ MGMT	61.	113.	174.
DATA	23.	5.	29.
SUBTOTAL(ENG)	615.	145.	760.
MANUFACTURING			
PRODUCTION	0.	2155.	2155.
PROTOTYPE	104.	0.	104.
TOOL-TEST EQ	12.	95.	107.
SUBTOTAL(MFG)	116.	2250.	2366.
TOTAL COST	731.	2394.	3126.

```
AVCOST              2.15            TOTAL AV PROD COST          2.39
WT      11.000 VOL        0.067 ECNS    0.030 NEWST   1.000 DESRPS 0.206
LCURVE  0.676                   ECNE    0.119 NEWEL   1.000 DESRPE 0.100

MECH/STRUCT
WS       9.500 WSCF    109.195 MECID    0.000 PRODS******* MCPLXS  5.520
ELECTRONICS
WE       1.500 WECF     34.483 CMPID    0.000 PRODE  4.641 MCPLXE  6.177
PWR     100.000 CMPNTS    235.                PWRFAC 0.222 CMPEFF 34.367

SCHEDULES
ENMTHS  95.000 ENMTHP  20.000 ENMTHT 26.000 ECMPLX 1.500 PRNF     0.122
PRMTHS 121.000 PRMTHF 152.745 AVERG PROD RATE PER MONTH          31.501
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	626.	1946.	2572.
CENTER	731.	2394.	3126.
TO	881.	3036.	3917.

```
MA600 INT TEST

                                                   PRICE  83B  4-OCT-78   12:39
INPUT DATA
QTY       1000. PROTOS    10.0 IWT      4.744 IVOL      0.060 MODE      5.
QTYSYS       1. INTEGE   0.000 INTEGS   0.000 AMULTD  150.00% AMULTP  150.00%

MECH/STRUCT
IWS      0.903 MCPLXS    5.264 PRODS    0.000 NEWST     0.300 DESRPS    0.000

ELECTRONICS
I-UVOL   0.999 MCPLXE    7.578 PRODE    0.000 NEWEL     0.500 DESRPE    0.000
PWR      0.000 CMPNTS       0. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   102.0 ENMTHP     13.0 ENMTHT    19.0 ECMPLX    0.000 PRNF      0.000

PRODUCTION
PRMTHS   121.0 PRMTHP      0.0 LCURVE   0.000 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC       0.00% PROUCT   1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM    1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	50.	6.	56.
DESIGN	165.	20.	185.
SYSTEMS	23.	0.	23.
PROJ MGMT	23.	133.	156.
DATA	8.	6.	14.
SUBTOTAL(ENG)	269.	166.	435.
MANUFACTURING			
PRODUCTION	0.	2557.	2557.
PROTOTYPE	80.	0.	80.
TOOL-TEST EQ	7.	81.	89.
SUBTOTAL(MFG)	87.	2639.	2726.
TOTAL COST	356.	2805.	3161.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	289.	2112.	2401.
CENTER	356.	2805.	3161.
TO	475.	4136.	4611.

ARCHITECTURE SEVEN

MA700 RF MODS L DUALT PREAMP

INPUT DATA PRICE 836 11-OCT-78 16:00
QTY 7000. PROTOS 70.0 WT 1.000 VOL 0.017 MODE 1.
QTYSYS 7. INTEGE 0.800 INTEGS 0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS 0.500 MCPLXS 5.520 PROOS 0.000 NEWST 1.000 DESRPS 2.000

ELECTRONICS
USEVOL 0.850 MCPLXE 6.021 PRODE 0.000 NEWEL 1.000 DESRPE 0.400
PWR 4.000 CMPNTS 102. CMPID 0.000 PWRFAC 0.000 CMPEFF 0.000

ENGINEERING
ENMTHS 102.0 ENMTHP 13.0 ENMTHT 19.0 ECMPLX 1.000 PRNF 0.000

PRODUCTION
PRMTHS 121.0 PRMTHF 0.0 LCURVE 0.851 ECNE 0.000 ECNS 0.000

GLOBAL
YEAR 1978. ESC 0.00% PROJCT 1.000 DATA 1.000 TLGTST 1.000
PLTFM 1.800 SYSTEM 1.000 PPROJ 1.000 PDATA 1.000 PTLGTS 1.00

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	18.	2.	21.
DESIGN	58.	7.	65.
SYSTEMS	6.	0.	6.
PROJ MGMT	13.	130.	143.
DATA	4.	6.	10.
SUBTOTAL(ENG)	100.	145.	245.
MANUFACTURING			
PRODUCTION	0.	1969.	1969.
PROTOTYPE	119.	0.	119.
TOOL-TEST EQ	9.	407.	416.
SUBTOTAL(MFG)	128.	2376.	2505.
TOTAL COST	229.	2521.	2749.

AVCOST 0.28 TOTAL AV PROD COST 0.36
WT 1.000 VOL 0.017 ECNS 0.037 NEWST 1.000 DESRPS 0.000
LCURVE 0.851 ECNE 0.145 NEWEL 1.000 DESRPE 0.400

MECH/STRUCT
WS 0.500 WSCF 29.412 MECID 0.000 PROOS 3.921 MCPLXS 5.520
ELECTRONICS
WE 0.500 WECF 34.602 CMPID 0.000 PRODE 4.550 MCPLXE 6.021
PWR 4.000 CMPNTS 102. PWRFAC 1.095 CMPEFF 8.936

SCHEDULES
ENMTHS 102.000 ENMTHP 13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF 0.039
PRMTHS 121.000 PRMTHF 162.630 AVER. PROD RATE PER MONTH 168.150

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	191.	2035.	2226.
CENTER	229.	2521.	2749.
TO	283.	3235.	3517.

```
MA700 RF MOD12 ANT SEL

INPUT DATA                               PRICE  636 11-OCT-78   18:02
QTY       9000. PROTOS   90.0 WT       1.000 VOL        0.017 MODE       1.
QTYSYS       9. INTEGE  0.800 INTEGS  0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS         0.700 MCPLXS  5.520 PRODS   0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.850 MCPLXE  8.115 PRODE   0.000 NEWEL     1.000 DESRPE   0.200
PWR     2.000 CMPNTS    50. CMPID   0.000 PWRFAC    0.000 CMPEFF   0.000

ENGINEERING
ENMTHS  103.0 ENMTHP   12.0 ENMTHT   16.0 ECMPLX    0.900 PRNF     0.000

PRODUCTION
PRMTHS  121.0 PRMTHF    0.0 LCURVE  0.831 ECNE      0.000 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT       PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                      17.               2.               19.
 DESIGN                        52.               7.               59.
 SYSTEMS                        5.               0.                5.
 PROJ MGMT                     13.             113.              126.
 DATA                           4.               5.                9.
  SUBTOTAL(ENG)                90.             127.              218.

MANUFACTURING
 PRODUCTION                     0.            1359.             1359.
 PROTOTYPE                    112.               0.              112.
 TOOL-TEST EQ                   8.             651.              659.
  SUBTOTAL(MFG)               120.            2010.             2129.

  TOTAL COST                  210.            2137.             2347.

AVCOST                 0.15          TOTAL AV PROD COST          0.24
WT        1.000 VOL        0.017 ECNS    0.037 NEWST   1.000 DESRPS 0.000
LCURVE  0.831                 ECNE    0.147 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS         0.700 WSCF    41.176 MECID   0.000 PRODS  3.836 MCPLXS  5.520
ELECTRONICS
WE         0.300 WECF    20.761 CMPID   0.000 PRODE  4.995 MCPLXE  8.115
PWR        2.000 CMPNTS     50.               PWRFAC 1.080 CMPEFF  4.682

SCHEDULES
ENMTHS 103.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.900 PRNF     0.033
PRMTHS 121.000 PRMTHF 165.447 AVER. PROD RATE PER MONTH        202.490

COST RANGES            DEVELOPMENT       PRODUCTION        TOTAL COST
      FROM                    178.            1752.             1929.
      CENTER                  210.            2137.             2347.
      TO                      254.            2664.             2918.
```

```
MA700 INT TEST

                                          PRICE  83B 11-OCT-78    18:04
INPUT DATA
QTY      1000. PROTOS    10.0 IWT     0.893 IVOL      0.014 MODE      5.
QTYSYS      1. INTEGE   0.000 INTEGS  0.000 AMULTD  150.00% AMULTP 150.00%

MECH/STRUCT
IWS     0.217 MCPLXS   5.213 PRODS   0.000 NEWST     0.300 DESRPS    0.000

ELECTRONICS
I-UVOL  0.999 MCPLXE   7.483 PRODE   0.000 NEWEL     0.500 DESRPE    0.000
PWR     0.000 CMPNTS      0. CMPID   0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP    13.0 ENMTHT   19.0 ECMPIX    0.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP     0.0 LCURVE  0.000 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT         PRODUCTION         TOTAL COST
ENGINEERING
 DRAFTING                         17.                 2.                19.
 DESIGN                           56.                 6.                62.
 SYSTEMS                           8.                 0.                 8.
 PROJ MGMT                         8.                27.                35.
 DATA                              3.                 1.                 4.
  SUBTOTAL(ENG)                   91.                37.               128.

MANUFACTURING
 PRODUCTION                        0.               513.               513.
 PROTOTYPE                        17.                 0.                17.
 TOOL-TEST EQ                      2.                31.                32.
  SUBTOTAL(MFG)                   18.               544.               562.

  TOTAL COST                     109.               580.               690.

COST RANGES               DEVELOPMENT         PRODUCTION         TOTAL COST
     FROM                         90.               450.               540.
     CENTER                      109.               580.               690.
     TO                          142.               814.               957.
```

```
MA700 RF MOD4 VAR FREQ IF

INPUT DATA                                   PRICE  636 11-OCT-78   16:08
QTY     33000. PROTOS   33.0 WT        1.500 VOL        0.017 MODE        1.
QTYSYS     33. INTEGE  0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       0.600 MCPLXS  5.520 PRODS     0.000 NEWST      1.000 DESRPS   2.000

ELECTRONICS
USEVOL   0.850 MCPLXE  8.115 PRODE     0.000 NEWEL      1.000 DESRPE   0.200
PWR      3.000 CMPNTS   100. CMPID     0.000 PWRFAC     0.000 CMPEFF   0.000

ENGINEERING
ENMTHS   102.0 ENMTHP   13.0 ENMTHT     19.0 ECMPLX     1.000 PRNF     0.000

PRODUCTION
PRMTHS   121.0 PRMTHP    0.0 LCURVE    0.811 ECNE       0.000 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT    1.000 DATA       1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ     1.000 PDATA      1.000 PTLGTS   1.000

PROGRAM COST             DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                        37.               6.              43.
 DESIGN                         118.              17.             134.
 SYSTEMS                         13.               0.              13.
 PROJ MGMT                       19.             897.             916.
 DATA                             6.              41.              47.
  SUBTOTAL(ENG)                 193.             960.            1153.

MANUFACTURING
 PRODUCTION                       0.            6282.            6282.
 PROTOTYPE                      102.               0.             102.
 TOOL-TEST EQ                     8.            8262.            8270.
  SUBTOTAL(MFG)                 110.           14545.           14655.

  TOTAL COST                    303.           15505.           15808.

AVCOST                 0.19            TOTAL AV PROD COST            0.47
WT       1.500 VOL         0.017 ECNS     0.044 NEWST   1.000 DESRPS 0.000
LCURVE   0.811                   ECNE     0.180 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS         0.600 WSCF     35.294 MECID    0.000 PRODS  3.875 MCPLXS  5.520
ELECTRONICS
WE         0.900 WECF     62.284 CMPID    0.000 PRODE  4.190 MCPLXE  8.115
PWR        3.000 CMPNTS    100.                 PWRFAC 1.310 CMPEFF -7.119

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.060
PRMTHS 121.000 PRMTHF 179.588 AVER. PROD RATE PER MONTH          563.260

COST RANGES              DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                       252.           11754.           12006.
     CENTER                     303.           15505.           15808.
     TO                         382.           21900.           22283.
```

MA700 RF MODS 70 MHZ IF

INPUT DATA   PRICE 83B 11-OCT-78   18:09

QTY	33000.	PROTOS	33.0	WT	1.500	VOL	0.017	MODE	1.
QTYSYS	33.	INTEGE	0.800	INTEGS	0.400	AMULTD	150.00%	AMULTP	150.00%

MECH/STRUCT

WS	0.600	MCPLXS	5.520	PRODS	0.000	NEWST	1.000	DESRPS	2.000

ELECTRONICS

USEVOL	0.850	MCPLXE	8.050	PRODE	0.000	NEWEL	1.000	DESRPE	0.200
PWR	4.000	CMPNTS	100.	CMPID	0.000	PWRFAC	0.000	CMPEFF	0.000

ENGINEERING

ENMTHS	102.0	ENMTHP	13.0	ENMTHT	19.0	ECMPLX	1.000	PRNF	0.000

PRODUCTION

PRMTHS	121.0	PRMTHF	0.0	LCURVE	0.811	ECNE	0.000	ECNS	0.000

GLOBAL

YEAR	1978.	ESC	0.00%	PROJCT	1.000	DATA	1.000	TLGTST	1.000
PLTFM	1.800	SYSTEM	1.000	PPROJ	1.000	PDATA	1.000	PTLGTS	1.00

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	37.	6.	42.
DESIGN	117.	16.	132.
SYSTEMS	13.	0.	13.
PROJ MGMT	19.	846.	865.
DATA	6.	38.	45.
SUBTOTAL(ENG)	191.	906.	1097.
MANUFACTURING			
PRODUCTION	0.	5958.	5958.
PROTOTYPE	98.	0.	98.
TOOL-TEST EQ	8.	7785.	7793.
SUBTOTAL(MFG)	106.	13744.	13849.
TOTAL COST	296.	14650.	14947.

AVCOST 0.18   TOTAL AV PROD COST 0.44

WT	1.500	VOL	0.017	ECNS	0.044	NEWST	1.000	DESRPS	0.000
LCURVE	0.811			ECNE	0.175	NEWEL	1.000	DESRPE	0.200

MECH/STRUCT

WS	0.600	WSCF	35.294	MECID	0.000	PRODS	3.875	MCPLXS	5.520

ELECTRONICS

WE	0.900	WECF	62.284	CMPID	0.000	PRODE	4.156	MCPLXE	8.050
PWR	4.000	CMPNTS	100.			PWRFAC	1.080	CMPEFF	-2.952

SCHEDULES

ENMTHS	102.000	ENMTHP	13.000	ENMTHT	19.000	ECMPLX	1.000	PRNF	0.060
PRMTHS	121.000	PRMTHF	178.867	AVER. PROD RATE PER MONTH					570.273

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	246.	11109.	11355.
CENTER	296.	14650.	14947.
TO	375.	20745.	21120.

```
MA700 RF MOD11 SHOP SYNTH

INPUT DATA                                     PRICE  836 11-OCT-78   18:11
QTY     26000. PROTOS  260.0 WT       2.000 VOL       0.035 MODE      1.
QTYSYS     26. INTEGE  0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.000 MCPLXS  5.520 PRODS    0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.650 MCPLXE  8.249 PRODE    0.000 NEWEL     1.000 DESRPE    0.200
PWR      4.000 CMPNTS   120. CMPID    0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP   13.0 ENMTHT   19.0 ECMPLX    1.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP    0.0 LCURVE  0.813 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                         41.                7.               47.
 DESIGN                          131.               21.              152.
 SYSTEMS                          14.                0.               14.
 PROJ MGMT                        63.              856.              919.
 DATA                             15.               39.               54.
  SUBTOTAL(ENG)                  263.              923.             1186.

MANUFACTURING
 PRODUCTION                        0.             6827.             6827.
 PROTOTYPE                       865.                0.              865.
 TOOL-TEST EQ                     65.             7462.             7526.
  SUBTOTAL(MFG)                  929.            14289.            15218.

  TOTAL COST                    1193.            15211.            16404.

AVCOST               0.26          TOTAL AV PROD COST              0.59
WT       2.000 VOL        0.035 ECNS     0.043 NEWST    1.000 DESRPS 0.000
LCURVE  0.813                 ECNE     0.185 NEWEL    1.000 DESRPE 0.200

MECH/STRUCT
WS        1.000 WSCF     28.571 MECID    0.000 PRODS  3.928 MCPLXS  5.520
ELECTRONICS
WE        1.000 WECF     33.613 CMPID    0.000 PRODE  4.701 MCPLXE  8.249
PWR       4.000 CMPNTS    120.                  PWRFAC 1.221 CMPEFF -4.951

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF    0.018
PRMTHS 121.000 PRMTHP 178.558 AVER. PROD RATE PER MONTH           451.778

COST RANGES               DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                        988.            11918.            12906.
     CENTER                     1193.            15211.            16404.
     TO                         1481.            19992.            21473.
```

```
MA700 RF MOD14 L TRAN

INPUT DATA                                   PRICE  83B 11-OCT-78    18:13
QTY      4000. PROTOS    40.0 WT        9.000 VOL       0.087 MODE       1.
QTYSYS      4. INTEGE   0.800 INTEGS    0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      7.000 MCPLXS   5.520 PRODS     0.000 NEWST     1.000 DESRPS    2.000

ELECTRONICS
USEVOL  0.600 MCPLXE   8.176 PRODE     0.000 NEWEL     1.000 DESRPE    0.100
PWR    90.000 CMPNTS    250. CMPID     0.000 PWRFAC    0.000 CMPEFF    0.000

ENGINEERING
ENMTHS   95.0 ENMTHP    20.0 ENMTHT    26.0 ECMPLX     1.500 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHF     0.0 LCURVE    0.856 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT    1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM   1.000 PPROJ     1.000 PDATA     1.000 PTLGTS     1.00

PROGRAM COST           DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                     121.              10.             131.
 DESIGN                       440.              30.             470.
 SYSTEMS                       78.               0.              78.
 PROJ MGMT                     94.             350.             444.
 DATA                          32.              16.              48.
  SUBTOTAL(ENG)               765.             406.            1171.

MANUFACTURING
 PRODUCTION                     0.            5895.            5895.
 PROTOTYPE                    396.               0.             396.
 TOOL-TEST EQ                  39.             611.             650.
  SUBTOTAL(MFG)               435.            6506.            6941.

  TOTAL COST                 1200.            6912.            8113.

AVCOST                1.47              TOTAL AV PROD COST            1.73
WT        9.000 VOL         0.087 ECNS     0.037 NEWST   1.000 DESRPS 0.000
LCURVE  0.856                   ECNE     0.151 NEWEL   1.000 DESRPE 0.100

MECH/STRUCT
WS        7.000 WSCF     80.460 MECID    0.000 PRODS   3.673 MCPLXS  5.520
ELECTRONICS
WE        2.000 WECF     38.314 CMPID    0.000 PRODE   4.563 MCPLXE  8.176
PWR      90.000 CMPNTS     250.                PWRFAC 0.248 CMPEFF 27.707

SCHEDULES
ENMTHS  95.000 ENMTHP  20.000 ENMTHT 26.000 ECMPLX 1.500 PRNF     0.053
PRMTHS 121.000 PRMTHF 161.547 AVER. PROD RATE PER MONTH          98.651

COST RANGES            DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                    1012.            5518.            6530.
     CENTER                  1200.            6912.            8113.
     TO                      1482.            9030.           10512.
```

MA700 RF MOD18 MULTI 6A EX

```
INPUT DATA                                     PRICE  836 11-OCT-78   18:15
QTY       9000. PROTOS    90.0 WT       1.500 VOL        0.017 MODE       1.
QTYSYS       9. INTEGE   0.800 INTEGS   0.400 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS        0.600 MCPLXS   5.520 PRODS    0.000 NEWST      1.000 DESRPS   2.000

ELECTRONICS
USEVOL    0.850 MCPLXE   8.115 PRODE    0.000 NEWEL      1.000 DESRPE   0.200
PWR       6.000 CMPNTS     80. CMPID    0.000 PWRFAC     0.000 CMPEFF   0.000

ENGINEERING
ENMTHS    102.0 ENMTHP    13.0 ENMTHT    19.0 ECMPLX     1.000 PRNF     0.000

PRODUCTION
PRMTHS    121.0 PRMTHF     0.0 LCURVE   0.831 ECNE       0.000 ECNS     0.000

GLOBAL
YEAR      1978. ESC      0.00% PROJCT   1.000 DATA       1.000 TLGTST   1.000
PLTFM     1.800 SYSTEM   1.000 PPROJ    1.000 PDATA      1.000 PTLGTS   1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	37.	5.	42.
DESIGN	118.	14.	132.
SYSTEMS	13.	0.	13.
PROJ MGMT	28.	260.	288.
DATA	8.	12.	20.
SUBTOTAL(ENG)	203.	291.	494.
MANUFACTURING			
PRODUCTION	0.	3215.	3215.
PROTOTYPE	258.	0.	258.
TOOL-TEST EQ	19.	1346.	1365.
SUBTOTAL(MFG)	277.	4561.	4838.
TOTAL COST	481.	4852.	5332.

```
AVCOST                 0.36          TOTAL AV PROD COST              0.54
WT        1.500 VOL           0.017 ECNS    0.037 NEWST   1.000 DESRPS 0.000
LCURVE    0.831                     ECNE    0.150 NEWEL   1.000 DESRPE 0.200

MECH/STRUCT
WS        0.600 WSCF     35.294 MECID    0.000 PRODS   3.875 MCPLXS   5.520
ELECTRONICS
WE        0.900 WECF     62.284 CMPID    0.000 PRODE   4.190 MCPLXE   8.115
PWR       6.000 CMPNTS      80.                PWRFAC  0.709 CMPEFF   0.590

SCHEDULES
ENMTHS 102.000 ENMTHP  13.000 ENMTHT 19.000 ECMPLX 1.000 PRNF      0.033
PRMTHS 121.000 PRMTHF 165.935 AVER. PROD RATE PER MONTH          200.288
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	395.	3771.	4166.
CENTER	481.	4852.	5332.
TO	616.	6645.	7261.

```
MA700 INT TEST

INPUT DATA                                      PRICE  83B 11-OCT-78    18:17
QTY      1000. PROTOS    10.0 IWT       13.410 IVOL       0.147 MODE        5.
QTYSYS      1. INTEGE   0.000 INTEGS     0.000 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
IWS     2.206 MCPLXS    5.491 PRODS      0.000 NEWST      0.300 DESRPS    0.000

ELECTRONICS
I-UVOL  0.999 MCPLXE    7.784 PRODE      0.000 NEWEL      0.500 DESRPE    0.000
PWR     0.000 CMPNTS       0. CMPID      0.000 PWRFAC     0.000 CMPEFF    0.000

ENGINEERING
ENMTHS  102.0 ENMTHP     13.0 ENMTHT      19.0 ECMPLX     0.000 PRNF      0.000

PRODUCTION
PRMTHS  121.0 PRMTHP      0.0 LCURVE     0.000 ECNE       0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC       0.00% PROJCT     1.000 DATA       1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM    1.000 PPROJ      1.000 PDATA      1.000 PTLGTS     1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	113.	20.	133.
DESIGN	370.	52.	421.
SYSTEMS	48.	0.	48.
PROJ MGMT	55.	402.	457.
DATA	18.	19.	38.
SUBTOTAL(ENG)	603.	493.	1097.
MANUFACTURING			
PRODUCTION	0.	7710.	7710.
PROTOTYPE	236.	0.	236.
TOOL-TEST EQ	21.	177.	198.
SUBTOTAL(MFG)	257.	7888.	8144.
TOTAL COST	860.	8381.	9241.

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	693.	6213.	6906.
CENTER	860.	8381.	9241.
TO	1156.	12607.	13763.

ANTENNAS

```
MA100 GPS ANT1

INPUT DATA                                 PRICE  83B  4-OCT-78   17:13
QTY      1000. PROTOS   10.0 WT       1.700 VOL        0.042 MODE      2.
QTYSYS      1. INTEGE  0.000 INTEGS   0.010 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS       1.700 MCPLXS  5.640 PRODS    0.000 NEWST      1.000 DESRPS   2.000

ENGINEERING
ENMTHS   98.0 ENMTHP    6.0 ENMTHT    12.0 ECMPLX     0.400 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHF    0.0 LCURVE   0.878                   ECNS     0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT  1.000 DATA       1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ    1.000 PDATA      1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	3.	0.	3.
DESIGN	7.	0.	7.
SYSTEMS	0.	0.	0.
PROJ MGMT	3.	9.	12.
DATA	1.	0.	1.
SUBTOTAL(ENG)	13.	10.	23.
MANUFACTURING			
PRODUCTION	0.	176.	176.
PROTOTYPE	8.	0.	8.
TOOL-TEST EQ	0.	25.	25.
SUBTOTAL(MFG)	8.	200.	208.
TOTAL COST	21.	210.	231.

```
AVCOST               0.18          TOTAL AV PROD COST               0.21
WT       1.700 VOL        0.042 ECNS    0.020 NEWST   1.000 DESRPS 0.000
LCURVE  0.878
MECH/STRUCT
WS        1.700 WSCF    40.476 MECID   0.000 PRODS  3.924 MCPLXS  5.640

SCHEDULES
ENMTHS  98.000 ENMTHP   6.000 ENMTHT 12.000 ECMPLX 0.400 PRNF    0.178
PRMTHS 116.000 PRMTHF 133.940 AVER. PROD RATE PER MONTH          55.741
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	18.	175.	192.
CENTER	21.	210.	231.
TO	27.	268.	295.

MA100 GPS ANT2

```
INPUT DATA                                    PRICE  836   4-OCT-78    17:15
QTY       1000. PROTOS    10.0 WT         1.000 VOL       0.025 MODE       2.
QTYSYS       1. INTEGE   0.000 INTEGS    0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       1.000 MCPLXS    5.640 PRODS     0.000 NEWST     1.000 DESRPS    2.000

ENGINEERING
ENMTHS    98.0 ENMTHP      6.0 ENMTHT     12.0 ECMPLX    0.400 PRNF      0.000

PRODUCTION
PRMTHS   116.0 PRMTHP      0.0 LCURVE    0.878                ECNS      0.000

GLOBAL
YEAR     1978. ESC       0.00% PROJCT    1.000 DATA      1.000 TLGTST    1.000
PLTFM    1.800 SYSTEM    1.000 PPROJ     1.000 PDATA     1.000 PTLGTS     1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	2.	0.	2.
DESIGN	5.	0.	5.
SYSTEMS	0.	0.	0.
PROJ MGMT	2.	7.	9.
DATA	1.	0.	1.
SUBTOTAL(ENG)	10.	8.	18.
MANUFACTURING			
PRODUCTION	0.	114.	114.
PROTOTYPE	5.	0.	5.
TOOL-TEST EQ	0.	42.	42.
SUBTOTAL(MFG)	5.	155.	160.
TOTAL COST	15.	163.	178.

```
AVCOST                 0.11          TOTAL AV PROD COST              0.16
WT        1.000 VOL       0.025 ECNS     0.019 NEWST    1.000 DESRPS 0.000
LCURVE  0.878
MECH/STRUCT
WS         1.000 WSCF    40.000 MECID    0.000 PRODS   3.927 MCPLXS  5.640

SCHEDULES
ENMTHS  98.000 ENMTHP   6.000 ENMTHT 12.000 ECMPLX 0.400 PRNF      0.178
PRMTHS 116.000 PRMTHP 133.744 AVER. PROD RATE PER MONTH           56.357
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	12.	137.	150.
CENTER	15.	163.	178.
TO	19.	204.	223.

MA100 JTIDS TACAN BLADE ANT

```
INPUT DATA                                    PRICE  83B  4-OCT-78   17:18
QTY      2000. PROTOS    0.0 WT       0.375 VOL       0.028 MODE       2.
QTYSYS      2. INTEGE  0.000 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      0.375 MCPLXS  5.640 PRODS    0.000 NEWST    0.000 DESRPS   0.000

ENGINEERING
ENMTHS    1.0 ENMTHP    0.0 ENMTHT    0.0 ECMPLX   0.100 PRNF      0.000

PRODUCTION
PRMTHS  116.0 PRMTHP    0.0 LCURVE   0.871                ECNS      0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT   1.000 DATA     1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ    1.000 PDATA    1.000 PTLGTS    1.00

PROGRAM COST           DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                       0.               0.               0.
 DESIGN                         0.               0.               0.
 SYSTEMS                        0.               0.               0.
 PROJ MGMT                      0.               6.               6.
 DATA                           0.               0.               0.
  SUBTOTAL(ENG)                 0.               7.               7.

MANUFACTURING
 PRODUCTION                     0.              79.              79.
 PROTOTYPE                      0.               0.               0.
 TOOL-TEST EQ                   0.              52.              52.
  SUBTOTAL(MFG)                 0.             131.             131.

  TOTAL COST                    0.             138.             138.

AVCOST             0.04          TOTAL AV PROD COST              0.07
WT       0.375 VOL      0.028 ECNS    0.018 NEWST    0.000 DESRPS 0.000
LCURVE   0.871
MECH/STRUCT
WS        0.375 WSCF    13.393 MECID   0.000 PRODS   4.217 MCPLXS  5.640

SCHEDULES
PRMTHS 116.000 PRMTHP 136.289 AVER. PROD RATE PER MONTH        98.574

COST RANGES            DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                       0.             119.             119.
     CENTER                     0.             138.             138.
     TO                         0.             165.             165.
```

```
MA100 JTIDS ARRAY ANT

INPUT DATA                                   PRICE  83B  4-OCT-78    17:16
QTY      1000. PROTOS   10.0 WT      5.000 VOL       0.231 MODE      2.
QTYSYS      1. INTEGE  0.000 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      5.000 MCPLXS  5.640 PRODS   0.000 NEWST     1.000 DESRPS   2.000

ENGINEERING
ENMTHS   98.0 ENMTHP    6.0 ENMTHT   12.0 ECMPLX    0.400 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHF    0.0 LCURVE  0.878                 ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST            DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                        5.               0.               5.
 DESIGN                         11.               1.              11.
 SYSTEMS                         0.               0.               0.
 PROJ MGMT                       5.              20.              25.
 DATA                            2.               1.               3.
  SUBTOTAL(ENG)                 23.              22.              45.

MANUFACTURING
 PRODUCTION                      0.             426.             426.
 PROTOTYPE                      19.               0.              19.
 TOOL-TEST EQ                    1.              31.              31.
  SUBTOTAL(MFG)                 19.             456.             475.

  TOTAL COST                    42.             478.             520.

AVCOST              0.43          TOTAL AV PROD COST              0.48
WT       5.000 VOL       0.231 ECNS    0.020 NEWST   1.000 DESRPS 0.062
LCURVE  0.878
MECH/STRUCT
WS        5.000 WSCF    21.645 MECID   0.000 PRODS  4.087 MCPLXS  5.640

SCHEDULES
ENMTHS  98.000 ENMTHP   6.000 ENMTHT 12.000 ECMPLX 0.400 PRNF    0.178
PRMTHS 116.000 PRMTHF 134.346 AVER. PROD RATE PER MONTH          54.509

COST RANGES             DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                       35.             397.             433.
     CENTER                     42.             478.             520.
     TO                         53.             604.             656.
```

```
MA100 SEEKTALK ANT

INPUT DATA                                   PRICE  836  4-OCT-78   17:20
QTY      1000. PROTOS   10.0 WT      16.200 VOL       0.750 MODE       2.
QTYSYS      1. INTEGE  0.000 INTEGS   0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS     16.200 MCPLXS  5.640 PRODS    0.000 NEWST     1.000 DESRPS   2.000

ENGINEERING
ENMTHS   96.0 ENMTHP    6.0 ENMTHT   12.0 ECMPLX    0.400 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHP    0.0 LCURVE  0.878                  ECNS     0.000

GLOBAL
YEAR    1978. ESC      0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ    1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                         10.                0.               10.
 DESIGN                           20.                1.               21.
 SYSTEMS                           1.                0.                1.
 PROJ MGMT                        11.               53.               63.
 DATA                              3.                3.                6.
  SUBTOTAL(ENG)                   45.               56.              101.

MANUFACTURING
 PRODUCTION                        0.             1118.             1118.
 PROTOTYPE                        50.                0.               50.
 TOOL-TEST EQ                      2.               58.               60.
  SUBTOTAL(MFG)                   51.             1176.             1227.

  TOTAL COST                      96.             1233.             1329.

AVCOST               1.12            TOTAL AV PROD COST                1.23
WT     16.200 VOL        0.750 ECNS    0.020 NEWST   1.000 DESRPS 0.232
LCURVE  0.878
MECH/STRUCT
WS      16.200 WSCF    21.600 MECID   0.000 PRODS  4.088 MCPLXS  5.640

SCHEDULES
ENMTHS  96.000 ENMTHP   6.000 ENMTHT 12.000 ECMPLX 0.400 PRNF     0.177
PRMTHS 116.000 PRMTHP 134.806 AVERL PROD RATE PER MONTH          53.174

COST RANGES               DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                         80.             1016.             1097.
     CENTER                       96.             1233.             1329.
     TO                          121.             1570.             1690.
```

MA100 UHF ANT

```
INPUT DATA                            PRICE  83B  4-OCT-78   17:21
QTY      2000. PROTOS    0.0 WT       1.500 VOL      0.012 MODE     2.
QTYSYS      1. INTEGE  0.000 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      1.500 MCPLXS  5.640 PRODS   0.000 NEWST    0.000 DESRPS   0.000

ENGINEERING
ENMTHS    1.0 ENMTHP    0.0 ENMTHT    0.0 ECMPLX   0.100 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHF    0.0 LCURVE  0.871                ECNS     0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS    1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	0.	0.	0.
DESIGN	0.	0.	0.
SYSTEMS	0.	0.	0.
PROJ MGMT	0.	14.	14.
DATA	0.	1.	1.
SUBTOTAL(ENG)	0.	15.	15.
MANUFACTURING			
PRODUCTION	0.	247.	247.
PROTOTYPE	0.	0.	0.
TOOL-TEST EQ	0.	40.	40.
SUBTOTAL(MFG)	0.	288.	288.
TOTAL COST	0.	303.	303.

```
AVCOST                0.12          TOTAL AV PROD COST         0.15
WT      1.500 VOL       0.012 ECNS    0.018 NEWST   0.000 DESRPS 0.000
LCURVE  0.871
MECH/STRUCT
WS        1.500 WSCF   125.000 MECID   0.000 PRODS  3.647 MCPLXS  5.640

SCHEDULES
PRMTHS 116.000 PRMTHF 136.873 AVER. PROD RATE PER MONTH        95.818
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	0.	248.	248.
CENTER	0.	303.	303.
TO	0.	402.	402.

```
MA100 VHF ANT1

INPUT DATA                                   PRICE  83B  4-OCT-78    17:23
QTY       1000. PROTOS   10.0 WT        5.000 VOL       0.037 MODE       2.
QTYSYS       1. INTEGE  0.000 INTEGS    0.010 AMULTD 150.00% AMULTF 150.00%

MECH/STRUCT
WS       5.000 MCPLXS  5.640 PRODS     0.000 NEWST     1.000 DESRPS   2.000

ENGINEERING
ENMTHS  111.0 ENMTHP    9.0 ENMTHT   15.0 ECMPLX    0.500 PRNF      0.000

PRODUCTION
PRMTHS  116.0 PRMTHP    0.0 LCURVE  0.878                  ECNS      0.000

GLOBAL
YEAR     1978. ESC      0.00% PROJCT  1.000 DATA      1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM   1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST             DEVELOPMENT       PRODUCTION       TOTAL COST
ENGINEERING
 DRAFTING                         9.                0.                9.
 DESIGN                          20.                1.               20.
 SYSTEMS                          1.                0.                1.
 PROJ MGMT                        6.               21.               27.
 DATA                             2.                1.                3.
  SUBTOTAL(ENG)                  38.               23.               61.

MANUFACTURING
 PRODUCTION                       0.              438.              438.
 PROTOTYPE                       22.                0.               22.
 TOOL-TEST EQ                     1.               32.               33.
  SUBTOTAL(MFG)                  23.              471.              493.

  TOTAL COST                     61.              493.              554.

AVCOST                  0.44           TOTAL AV PROD COST             0.49
WT       5.000 VOL         0.037 ECNS     0.022 NEWST    1.000 DESRPS 0.000
LCURVE  0.878
MECH/STRUCT
WS        5.000 WSCF    135.135 MECID    0.000 PRODS  3.628 MCPLXS   5.640

SCHEDULES
ENMTHS 111.000 ENMTHP   9.000 ENMTHT 15.000 ECMPLX 0.500 PRNF     0.178
PRMTHS 116.000 PRMTHP 134.301 AVER. PROD RATE PER MONTH          54.641

COST RANGES              DEVELOPMENT       PRODUCTION       TOTAL COST
     FROM                        50.              399.              448.
     CENTER                      61.              493.              554.
     TO                          80.              667.              747.
```

```
MA100 VHF ANT2

INPUT DATA                              PRICE  83B  4-OCT-78   17:24
QTY       1000. PROTOS   10.0 WT      6.500 VOL       0.111 MODE      2.
QTYSYS       1. INTEGE  0.000 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS       6.500 MCPLXS  5.640 PRODS   0.000 NEWST    1.000 DESRPS   0.000

ENGINEERING
ENMTHS  111.0 ENMTHP    9.0 ENMTHT  15.0 ECMPLX   0.500 PRNF     0.000

PRODUCTION
PRMTHS  116.0 PRMTHF    0.0 LCURVE  0.878                 ECNS     0.000

GLOBAL
YEAR     1978. ESC     0.00% PROJCT  1.000 DATA     1.000 TLGTST   1.000
PLTFM    1.800 SYSTEM  1.000 PPROJ   1.000 PDATA    1.000 PTLGTS   1.00
```

PROGRAM COST	DEVELOPMENT	PRODUCTION	TOTAL COST
ENGINEERING			
DRAFTING	9.	0.	9.
DESIGN	20.	1.	21.
SYSTEMS	1.	0.	1.
PROJ MGMT	7.	26.	32.
DATA	2.	1.	3.
SUBTOTAL(ENG)	40.	28.	67.
MANUFACTURING			
PRODUCTION	0.	544.	544.
PROTOTYPE	27.	0.	27.
TOOL-TEST EQ	1.	37.	39.
SUBTOTAL(MFG)	28.	581.	609.
TOTAL COST	68.	609.	677.

```
AVCOST               0.54            TOTAL AV PROD COST          0.61
WT       6.500 VOL        0.111 ECNS    0.022 NEWST   1.000 DESRPS 0.000
LCURVE   0.878
MECH/STRUCT
WS         6.500 WSCF    58.559 MECID   0.000 PRODS  3.831 MCPLXS  5.640

SCHEDULES
ENMTHS 111.000 ENMTHP   9.000 ENMTHT 15.000 ECMPLX 0.500 PRNF     0.178
PRMTHS 116.000 PRMTHF 134.401 AVER. PROD RATE PER MONTH          54.344
```

COST RANGES	DEVELOPMENT	PRODUCTION	TOTAL COST
FROM	56.	497.	554.
CENTER	68.	609.	677.
TO	88.	798.	885.

```
MA100 HF ANT

INPUT DATA                                PRICE  83B 29-SEP-78    15:46
QTY       1000. PROTOS    10.0 WT      25.000 VOL       1.050 MODE      1.
QTYSYS       1. INTEGE  0.010 INTEGS  0.010 AMULTD 150.00% AMULTP 150.00%

MECH/STRUCT
WS      24.600 MCPLXS  7.382 PRODS   0.000 NEWST     1.000 DESRPS   2.000

ELECTRONICS
USEVOL  0.010 MCPLXE  7.935 PRODE   0.000 NEWEL     1.000 DESRPE   2.000
PWR     0.009 CMPNTS      0. CMPID   0.000 PWRFAC    2.000 CMPEFF  10.000

ENGINEERING
ENMTHS   98.0 ENMTHP   12.0 ENMTHT   18.0 ECMPLX    0.800 PRNF      0.000

PRODUCTION
PRMTHS  116.0 PRMTHF    0.0 LCURVE  0.878 ECNE      0.000 ECNS      0.000

GLOBAL
YEAR    1978. ESC     0.00% PROJCT  1.000 DATA      1.000 TLGTST    1.000
PLTFM   1.800 SYSTEM  1.000 PPROJ   1.000 PDATA     1.000 PTLGTS    1.00

PROGRAM COST              DEVELOPMENT        PRODUCTION        TOTAL COST
ENGINEERING
 DRAFTING                         51.                4.               56.
 DESIGN                          151.               13.              163.
 SYSTEMS                          12.                0.               12.
 PROJ MGMT                        40.              446.              487.
 DATA                             12.               21.               33.
  SUBTOTAL(ENG)                  266.              484.              750.

MANUFACTURING
 PRODUCTION                        0.             8429.             8429.
 PROTOTYPE                       333.                0.              333.
 TOOL-TEST EQ                     23.              310.              333.
  SUBTOTAL(MFG)                  356.             8740.             9095.

  TOTAL COST                     622.             9224.             9845.

AVCOST                 8.43            TOTAL AV PROD COST            9.22
WT      25.000 VOL          1.050 ECNS    0.060 NEWST   1.000 DESRPS 0.578
LCURVE  0.878                     ECNE    0.102 NEWEL   1.000 DESRPE 0.000

MECH/STRUCT
WS       24.600 WSCF     23.429 MECID   0.000 PRODS  5.322 MCPLXS  7.382
ELECTRONICS
WE        0.400 WECF     38.095 CMPID   0.000 PRODE  4.432 MCPLXE  7.935
PWR       2.449 CMPNTS    153.                PWRFAC 2.000 CMPEFF 10.000

SCHEDULES
ENMTHS  98.000 ENMTHP  12.000 ENMTHT 18.000 ECMPLX 0.800 PRNF     0.126
PRMTHS 116.000 PRMTHF 146.797 AVER. PROD RATE PER MONTH          32.471

COST RANGES               DEVELOPMENT        PRODUCTION        TOTAL COST
     FROM                        530.             7708.             8238.
     CENTER                      622.             9224.             9845.
     TO                          738.            11006.            11744.
```

APPENDIX G

SOFTWARE COST INPUT AND OUTPUT DATA

APPENDIX G

Software cost input and output data obtained from PRICE S are presented in this Appendix. See Section 4.2 for associated discussion. All costs are $1,000. These software data are the same for all integrated architectures. There are no software costs included for dedicated architectures.

--- PRICE SOFTWARE MODEL ---

DATE 17-OCT-78   TIME 18:09

BARS   NBSP: GPS

INPUT DATA

FILENAME: SMES2   DATED: 22 SEPT 78

DESCRIPTORS

INSTRUCTIONS	20000	APPLICATION	0.000	RESOURCE	3.500
FUNCTIONS	0	STRUCTURE	0.000	LEVEL	0.000

APPLICATION CATEGORIES	MIX	NEW DEVELOPMENT DESIGN	CODE	SYSTEM CONFIGURATION TYPES	QUANTITY
DATA S/R	0.00	1.00	1.00	1	1
ONLINE COMM	0.00	1.00	1.00	1	1
REALTIME C&C	0.80	1.00	1.00	1	1
INTERACTIVE	0.00	1.00	1.00	1	1
MATHEMATICAL	0.20	1.00	1.00	***	***
STRING MANIP	0.00	1.00	1.00	***	***
OPR SYSTEMS	0.00	1.00	1.00	***	***

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	0	T&I START	0
DESIGN END	0	IMPL END	0	T&I END	0

SUPPLEMENTAL INFORMATION

YEAR	1978	ESCALATION	0.000	TECH IMP	1.00
MULTIPLIER	1.500	PLATFORM	1.8	UTILIZATION	0.63

PROGRAM COSTS

COST ELEMENTS	DESIGN	IMPL	T & I	TOTAL
SYSTEMS ENGINEERING	315.	14.	258.	587.
PROGRAMMING	68.	77.	106.	250.
CONFIGURATION CONTROL	52.	22.	170.	245.
DOCUMENTATION	52.	8.	79.	138.
PROGRAM MANAGEMENT	42.	7.	35.	84.
TOTAL	530.	127.	648.	1305.

ADDITIONAL DATA

DESCRIPTORS

INSTRUCTIONS	20000	APPLICATION	6.941	RESOURCE	3.500
FUNCTIONS	222	STRUCTURE	0.000	LEVEL	0.000

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	APR 85	T&I START	JUL 85
DESIGN END	SEP 85	IMPL END	DEC 85	T&I END	JUL 86

SCHEDULE GRAPH

```
JAN 85                                                                   JUL 86
************* DESIGN **************
          ************* IMPLEMENT *************
                         ****************** TEST & INTEGRATE ******************
```

--- PRICE SOFTWARE MODEL ---

DATE 17-OCT-78   TIME 18:26

FBARS   NBSP: SEEKTALK

INPUT DATA

FILENAME: SMFS3   DATED: 22 SEPT 78

DESCRIPTORS

INSTRUCTIONS	10000	APPLICATION	0.000	RESOURCE	3.500
FUNCTIONS	0	STRUCTURE	0.000	LEVEL	0.000

APPLICATION CATEGORIES	MIX	NEW DEVELOPMENT DESIGN	CODE	SYSTEM CONFIGURATION TYPES	QUANTITY
DATA S/R	0.00	1.00	1.00	1	1
ONLINE COMM	0.00	1.00	1.00	1	1
REALTIME C&C	0.80	1.00	1.00	1	1
INTERACTIVE	0.00	1.00	1.00	1	1
MATHEMATICAL	0.20	1.00	1.00	***	***
STRING MANIP	0.00	1.00	1.00	***	***
OPR SYSTEMS	0.00	1.00	1.00	***	***

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	0	T&I START	0
DESIGN END	0	IMPL END	0	T&I END	0

SUPPLEMENTAL INFORMATION

YEAR	1978	ESCALATION	0.000	TECH IMP	1.00
MULTIPLIER	1.500	PLATFORM	1.8	UTILIZATION	0.63

PROGRAM COSTS

COST ELEMENTS	DESIGN	IMPL	T & I	TOTAL
SYSTEMS ENGINEERING	161.	7.	131.	299.
PROGRAMMING	35.	39.	54.	127.
CONFIGURATION CONTROL	25.	10.	80.	115.
DOCUMENTATION	24.	4.	36.	64.
PROGRAM MANAGEMENT	20.	3.	16.	39.
TOTAL	264.	63.	318.	645.

ADDITIONAL DATA

DESCRIPTORS

INSTRUCTIONS	10000	APPLICATION	6.941	RESOURCE	3.500
FUNCTIONS	111	STRUCTURE	0.000	LEVEL	0.000

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	MAR 85	T&I START	JUN 85
DESIGN END	JUL 85	IMPL END	OCT 85	T&I END	MAR 86

SCHEDULE GRAPH

```
JAN 85                                                              MAR 86
************ DESIGN *************
        ************* IMPLEMENT *************
                          ***************** TEST & INTEGRATE *****************
```

--- PRICE SOFTWARE MODEL ---

DATE 17-OCT-78 TIME 18:34

BARS NBSP: ADAPTIVE ANTENNA

INPUT DATA

FILENAME: SMES6 DATED: 28 SEPT 78

DESCRIPTORS

INSTRUCTIONS	4000	APPLICATION	0.000	RESOURCE	3.500
FUNCTIONS	0	STRUCTURE	0.000	LEVEL	0.000

APPLICATION CATEGORIES		NEW DEVELOPMENT		SYSTEM CONFIGURATION	
	MIX	DESIGN	CODE	TYPES	QUANTITY
DATA S/R	0.00	1.00	1.00	1	1
ONLINE COMM	0.00	1.00	1.00	1	1
REALTIME C&C	0.80	1.00	1.00	1	1
INTERACTIVE	0.00	1.00	1.00	1	1
MATHEMATICAL	0.20	1.00	1.00	***	***
STRING MANIP	0.00	1.00	1.00	***	***
OPR SYSTEMS	0.00	1.00	1.00	***	***

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	0	T&I START	0
DESIGN END	0	IMPL END	0	T&I END	0

SUPPLEMENTAL INFORMATION

YEAR	1978	ESCALATION	0.000	TECH IMP	1.00
MULTIPLIER	1.500	PLATFORM	1.8	UTILIZATION	0.67

PROGRAM COSTS

COST ELEMENTS	DESIGN	IMPL	T & I	TOTAL
SYSTEMS ENGINEERING	70.	3.	57.	130.
PROGRAMMING	15.	17.	23.	55.
CONFIGURATION CONTROL	10.	4.	31.	45.
DOCUMENTATION	9.	1.	14.	24.
PROGRAM MANAGEMENT	7.	1.	6.	15.
TOTAL	111.	26.	131.	268.

ADDITIONAL DATA

DESCRIPTORS

INSTRUCTIONS	4000	APPLICATION	6.941	RESOURCE	3.500
FUNCTIONS	44	STRUCTURE	0.000	LEVEL	0.000

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	MAR 85	T&I START	APR 85
DESIGN END	MAY 85	IMPL END	JUL 85	T&I END	NOV 85

SCHEDULE GRAPH

```
JAN 85                                                              NOV 85
*********** DESIGN *************
         ************* IMPLEMENT *************
                         **************** TEST & INTEGRATE *****************
```

--- PRICE SOFTWARE MODEL ---

DATE 17-OCT-78 TIME 18:03

FBARS NBSP: CONVENTIONAL COMMUNICATIONS

INPUT DATA

FILENAME: SMES1 DATED: 22 SEPT 78

DESCRIPTORS

INSTRUCTIONS	2000	APPLICATION	0.000	RESOURCE	3.500
FUNCTIONS	0	STRUCTURE	0.000	LEVEL	0.000

APPLICATION CATEGORIES	MIX	NEW DEVELOPMENT DESIGN	CODE	SYSTEM CONFIGURATION TYPES	QUANTITY
DATA S/R	0.00	1.00	1.00	1	1
ONLINE COMM	0.00	1.00	1.00	0	0
REALTIME C&C	1.00	1.00	1.00	0	0
INTERACTIVE	0.00	1.00	1.00	0	0
MATHEMATICAL	0.00	1.00	1.00	***	***
STRING MANIP	0.00	1.00	1.00	***	***
OPR SYSTEMS	0.00	1.00	1.00	***	***

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	0	T&I START	0
DESIGN END	0	IMPL END	0	T&I END	0

SUPPLEMENTAL INFORMATION

YEAR	1978	ESCALATION	0.000	TECH IMP	1.00
MULTIPLIER	1.500	PLATFORM	1.8	UTILIZATION	0.83

PROGRAM COSTS

COST ELEMENTS	DESIGN	IMPL	T & I	TOTAL
SYSTEMS ENGINEERING	60.	2.	49.	111.
PROGRAMMING	13.	12.	20.	45.
CONFIGURATION CONTROL	7.	3.	24.	35.
DOCUMENTATION	7.	1.	10.	18.
PROGRAM MANAGEMENT	6.	1.	5.	11.
TOTAL	94.	18.	109.	221.

ADDITIONAL DATA

DESCRIPTORS

INSTRUCTIONS	2000	APPLICATION	0.460	RESOURCE	3.500
FUNCTIONS	22	STRUCTURE	0.000	LEVEL	0.000

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	FEB 85	T&I START	APR 85
DESIGN END	MAY 85	IMPL END	JUL 85	T&I END	OCT 85

SCHEDULE GRAPH

```
JAN 85                                                              OCT 85
************ DESIGN *************
         ************* IMPLEMENT *************
                    ***************** TEST & INTEGRATE *****************
```

--- PRICE SOFTWARE MODEL ---

DATE 17-OCT-78 TIME 18:29

FBARS WBSF

INPUT DATA

FILENAME: SMFS4 DATED: 22 SEPT 78

DESCRIPTORS

INSTRUCTIONS	30000	APPLICATION	0.000	RESOURCE	3.500
FUNCTIONS	0	STRUCTURE	0.000	LEVEL	0.000

APPLICATION CATEGORIES		NEW DEVELOPMENT		SYSTEM CONFIGURATION	
	MIX	DESIGN	CODE	TYPES	QUANTITY
DATA S/R	0.00	1.00	1.00	1	1
ONLINE COMM	0.00	1.00	1.00	1	1
REALTIME C&C	0.85	1.00	1.00	1	1
INTERACTIVE	0.00	1.00	1.00	1	1
MTHEMATICAL	0.00	1.00	1.00	***	***
STRING MANIP	0.00	1.00	1.00	***	***
OPR SYSTEMS	0.15	1.00	1.00	***	***

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	0	T&I START	0
DESIGN END	0	IMPL END	0	T&I END	0

SUPPLEMENTAL INFORMATION

YEAR	1978	ESCALATION	0.000	TECH IMP	1.00
MULTIPLIER	1.500	PLATFORM	1.8	UTILIZATION	0.69

PROGRAM COSTS

COST ELEMENTS	DESIGN	IMPL	T & I	TOTAL
SYSTEMS ENGINEERING	645.	27.	527.	1199.
PROGRAMMING	139.	151.	216.	506.
CONFIGURATION CONTROL	111.	45.	363.	520.
DOCUMENTATION	112.	16.	170.	297.
PROGRAM MANAGEMENT	91.	14.	77.	182.
TOTAL	1098.	253.	1353.	2704.

ADDITIONAL DATA

DESCRIPTORS

INSTRUCTIONS	30000	APPLICATION	8.834	RESOURCE	3.500
FUNCTIONS	333	STRUCTURE	0.000	LEVEL	0.000

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	MAY 85	T&I START	AUG 85
DESIGN END	NOV 85	IMPL END	MAR 86	T&I END	DEC 86

SCHEDULE GRAPH

```
JAN 85                                                              DEC 86
************ DESIGN *************
          ************* IMPLEMENT *************
                      ***************** TEST & INTEGRATE ******************
```

--- PRICE SOFTWARE MODEL ---

DATE 17-OCT-78 TIME 18:32

FBARS CONTROL PROCESSOR

INPUT DATA

FILENAME: SMFS5 DATED: 22 SEPT 78

DESCRIPTORS

INSTRUCTIONS	76000	APPLICATION	0.000	RESOURCE	3.500
FUNCTIONS	0	STRUCTURE	0.000	LEVEL	0.000

APPLICATION CATEGORIES		NEW DEVELOPMENT		SYSTEM CONFIGURATION	
	MIX	DESIGN	CODE	TYPES	QUANTITY
DATA S/R	0.20	1.00	1.00	1	1
ONLINE COMM	0.00	1.00	1.00	1	1
REALTIME C&C	0.20	1.00	1.00	1	1
INTERACTIVE	0.00	1.00	1.00	1	1
MATHEMATICAL	0.50	1.00	1.00	***	***
STRING MANIP	0.00	1.00	1.00	***	***
OPR SYSTEMS	0.10	1.00	1.00	***	***

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	0	T&I START	0
DESIGN END	0	IMPL END	0	T&I END	0

SUPPLEMENTAL INFORMATION

YEAR	1978	ESCALATION	0.000	TECH IMP	1.00
MULTIPLIER	1.500	PLATFORM	1.8	UTILIZATION	0.69

PROGRAM COSTS

COST ELEMENTS	DESIGN	IMPL	T & I	TOTAL
SYSTEMS ENGINEERING	739.	31.	604.	1375.
PROGRAMMING	160.	173.	247.	580.
CONFIGURATION CONTROL	140.	57.	456.	653.
DOCUMENTATION	142.	20.	220.	382.
PROGRAM MANAGEMENT	117.	18.	101.	236.
TOTAL	1298.	299.	1629.	3226.

ADDITIONAL DATA

DESCRIPTORS

INSTRUCTIONS	76000	APPLICATION	4.041	RESOURCE	3.500
FUNCTIONS	844	STRUCTURE	0.000	LEVEL	0.000

SCHEDULE

COMPLEXITY	1.000				
DESIGN START	JAN 85	IMPL START	MAY 85	T&I START	SEP 85
DESIGN END	NOV 85	IMPL END	APR 86	T&I END	JAN 87

SCHEDULE GRAPH

```
JAN 85                                                              JAN 87
************ DESIGN *************
           ************* IMPLEMENT *************
                      ***************** TEST & INTEGRATE *****************
```

APPENDIX H

SUPPORT COST DETAIL DATA

APPENDIX H

SUPPORT COST DETAIL DATA

Support and life cycle cost input and output data obtained from PRICE L1 are presented in this Appendix. See Section 4.3 for associated discussion. All costs are $1,000. There are currently PRICE L1 files only for Architectures One and Three.

The results from Appendix H have been categorized and extrapolated in Section 3 so that support costs are obtained for all seven architectures and for features (e.g., power supply, BITE, etc.) within each architecture.

<u>Architecture One</u> – MA100 in the unit title identifies Architecture One.

<u>Architecture Three</u> – MA300 in the unit titles identifies Architecture Three.

ARCHITECTURE ONE

LC FILE INPUT DATA

```
MA100 GPS

DEPLOYMENT
EQUIPS(ED)     1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD)  2

DURATION OF SUPPORT PERIOD,YEARS(YR)                   10.00
ON-TIME FRACTION(OTF)                                    .041

LRU MTBF,HOURS(MTBF)                                  183.
LRU REPAIR TIME,HOURS(TP)                               1.36
MODULE REPAIR TIME,HOURS(TMO)                           2.77
LRU PER SYSTEM,(EE)                                     1.
LRU COST,$(CUP)                                     21211.
MODULE COST,$(CMP)                                   1156.98
PART COST,$(CPP)                                      144.62
PART COST ON-EQUIPMENT REPAIR,$(CPPE)                 144.62
DEVELOPMENT COST,$(CEND)                         17728683.
NON-RECURRING PRODUCTION COST,$(CPE)              2104808.
CONTRACTOR LRU REPAIR COST,$(CUR)                    1060.56
CONTRACTOR MODULE REPAIR COST,$(CMR)                  404.94
MODULE TYPES,(P)                                       39.
PART TYPES,(PP)                                       164.
FRACTION NON-STD.PARTS,(FNSP)                           0.50
LRU SUPPORT EQPT. COST,$(CFIM)                     117189.
LRU+MODULE SUPPORT EQPT.,$(CFIP)                   148143.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)                      2.48
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)               3.14

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP)          0.878    MODULE(EMP)         0.939  PART(EPP)          0.970

REFERENCE QUANTITIES:
UNIT(RNU)       1000.       MODULE(RNM)      1000.     PART(RNP)      1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU)          60.0      MODULE(WM)          0.64   PART(WP)           0.080

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU)        0.816    MODULE(CUBEM)       0.015  PART(CUBEP)        0.0019

DEVELOPMENT PHASE, YEARS (YD)                   2.67
PRODUCTION PHASE, YEARS (YP)                    2.65
```

PRICE LIFE CYCLE COST

MA100 GPS LC: MC1

INPUT DATA

R&M DATA

MTBF	183.	MTTR-LRU	1.4	MTTR-MOD	2.8

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	39.	PARTS/LRU	164.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	17729.	23086.	0.	40815.
SUPPORT EQUIP	0.	3259.	3259.	6518.
MANPOWER	0.	0.	1804.	1804.
SUPPLY	0.	3068.	5197.	8265.
SUPPLY ADM.	0.	12.	122.	134.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	577.	577.
TOTAL COST	17729.	29425.	10960.	58114.

AVAILABILITY

INHERENT	0.9688	OPERATIONAL	0.9688

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.917	0.038

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	63.	28.	42.
BALANCE CONSUMED	126.964	0.000	74.017

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 653.1
MA100 JTIDS 1 OF 3

LC FILE INPUT DATA

MA100 JTIDS 1 OF 3

DEPLOYMENT

EQUIPS(ED)	1000.	ORGANIZATION(OD)	0.	INTERMEDIATE(DI)	20.	DEPOT(DD)	2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	570.
LRU REPAIR TIME,HOURS(TF)	1.52
MODULE REPAIR TIME,HOURS(TMO)	3.08
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	11553.
MODULE COST,$(CMP)	1650.46
PART COST,$(CPP)	78.59
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	78.59
DEVELOPMENT COST,$(CEND)	10138102.
NON-RECURRING PRODUCTION COST,$(CPE)	1162677.
CONTRACTOR LRU REPAIR COST,$(CUR)	577.66
CONTRACTOR MODULE REPAIR COST,$(CMR)	577.66
MODULE TYPES,(P)	20.
PART TYPES,(PP)	170.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	98787.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	114868.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	2.09
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	2.43

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	50.0	MODULE(WM)	0.57	PART(WP)	0.027

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.556	MODULE(CUBEM)	0.026	PART(CUBEP)	0.0013

DEVELOPMENT PHASE, YEARS (YD)	2.67
PRODUCTION PHASE, YEARS (YP)	2.75

PRICE LIFE CYCLE COST

MA100 JTIDS 1 OF 3 LC: MC1

INPUT DATA

R&M DATA
MTBF 570. MTTR-LRU 1.5 MTTR-MOD 3.1

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 20. PARTS/LRU 170.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 3
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	10138.	12639.	0.	22777.
SUPPORT EQUIP	0.	2527.	2527.	5054.
MANPOWER	0.	0.	645.	645.
SUPPLY	0.	1553.	559.	2112.
SUPPLY ADM.	0.	11.	106.	117.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	158.	158.
TOTAL COST	10138.	16730.	3995.	30863.

AVAILABILITY
INHERENT 0.9898 OPERATIONAL 0.9898

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.335	0.014

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	38.	28.	30.
BALANCE CONSUMED	24.308	0.000	6.711

COST/EFFECTIVENESS LIST (%)
3= 100.0 1= 306.3
MA100 JTIDS 2 OF 3

LC FILE INPUT DATA

MA100 JTIDS 2 OF 3

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) [illegible]

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	570.
LRU REPAIR TIME,HOURS(TF)	1.52
MODULE REPAIR TIME,HOURS(TMO)	3.08
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	11553.
MODULE COST,$(CMP)	1650.46
PART COST,$(CPP)	78.59
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	78.59
DEVELOPMENT COST,$(CEND)	10138102.
NON-RECURRING PRODUCTION COST,$(CPE)	1162677.
CONTRACTOR LRU REPAIR COST,$(CUR)	577.66
CONTRACTOR MODULE REPAIR COST,$(CMR)	577.66
MODULE TYPES,(P)	20.
PART TYPES,(PP)	170.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	98787.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	114868.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	2.09
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	2.43

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	50.0	MODULE(WM)	0.57	PART(WP)	0.027

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.556	MODULE(CUBEM)	0.026	PART(CUBEP)	0.0013

DEVELOPMENT PHASE, YEARS (YD)	2.67
PRODUCTION PHASE, YEARS (YP)	2.75

PRICE LIFE CYCLE COST

MA100 JTIDS 2 OF 3 LC: MC

INPUT DATA

R&M DATA

MTBF	570.	MTTR-LRU	1.5	MTTR-MOD	3.1

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	30.	PARTS/LRU	170.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	10138.	12639.	0.	22777.
SUPPORT EQUIP	0.	2527.	2527.	5054
MANPOWER	0.	0.	645.	645
SUPPLY	0.	1553.	559.	2112
SUPPLY ADM.	0.	11.	106.	117
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	158.	158
TOTAL COST	10138.	16730.	3995.	30863.

AVAILABILITY

INHERENT	0.9898	OPERATIONAL	0.9898

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.335	0.014

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	38.	28.	30.
BALANCE CONSUMED	24.308	0.000	6.711

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 306.3
MA100 JTIDS 3 OF 3

LC FILE INPUT DATA

MA100 JTIDS 3 OF 3

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	570.
LRU REPAIR TIME,HOURS(TF)	1.52
MODULE REPAIR TIME,HOURS(TMD)	3.08
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	11553.
MODULE COST,$(CMP)	1650.46
PART COST,$(CPP)	78.59
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	78.59
DEVELOPMENT COST,$(CEND)	10138102.
NON-RECURRING PRODUCTION COST,$(CPE)	1162677.
CONTRACTOR LRU REPAIR COST,$(CUR)	577.66
CONTRACTOR MODULE REPAIR COST,$(CMR)	577.66
MODULE TYPES,(P)	20.
PART TYPES,(PP)	170.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	98787.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	114868.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	2.09
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	2.43

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 50.0 MODULE(WM) 0.57 PART(WP) 0.027

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.556 MODULE(CUBEM) 0.026 PART(CUBEP) 0.0013

DEVELOPMENT PHASE, YEARS (YD)	2.67
PRODUCTION PHASE, YEARS (YP)	2.75

PRICE LIFE CYCLE COST

MA100 JTIDS 3 OF 3 LC: MC1

INPUT DATA

R&M DATA
MTBF 570. MTTR-LRU 1.5 MTTR-MOD 3.1

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 20. PARTS/LRU 170.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	10138.	12639.	0.	22777.
SUPPORT EQUIP	0.	2527.	2527.	5054.
MANPOWER	0.	0.	645.	645.
SUPPLY	0.	1553.	559.	2112.
SUPPLY ADM.	0.	11.	106.	117.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	158.	158.
TOTAL COST	10138.	16730.	3995.	30863.

AVAILABILITY
INHERENT 0.9898 OPERATIONAL 0.9898

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.335	0.014

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	38.	28.	30.
BALANCE CONSUMED	24.308	0.000	6.711

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 306.3
MA100 SEEKTALK

LC FILE INPUT DATA

```
MA100 SEEKTALK

DEPLOYMENT
EQUIPS(ED)     1000. ORGANIZATION(OD)    0. INTERMEDIATE(DI) 20. DEPOT(DD)  2.

DURATION OF SUPPORT PERIOD,YEARS(YR)                 10.00
ON-TIME FRACTION(OTF)                                  .041

LRU MTBF,HOURS(MTBF)                                448.
LRU REPAIR TIME,HOURS(TF)                             1.46
MODULE REPAIR TIME,HOURS(TMO)                         3.01
LRU PER SYSTEM,(EE)                                   1.
LRU COST,$(CUP)                                   11732.
MODULE COST,$(CMP)                                 1407.89
PART COST,$(CPP)                                     67.04
PART COST ON-EQUIPMENT REPAIR,$(CPPE)                67.04
DEVELOPMENT COST,$(CEND)                       10570798.
NON-RECURRING PRODUCTION COST,$(CPE)            1184062.
CONTRACTOR LRU REPAIR COST,$(CUR)                   586.62
CONTRACTOR MODULE REPAIR COST,$(CMR)                492.76
MODULE TYPES,(P)                                     23.
PART TYPES,(PP)                                     188.
FRACTION NON-STD.PARTS,(PNSP)                         0.50
LRU SUPPORT EQPT. COST,$(CFIM)                    98141.
LRU+MODULE SUPPORT EQPT.,$(CFIP)                 114117.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)                    2.08
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)             2.42


COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP)          0.878    MODULE(EMP)        0.939  PART(EPP)          0.970

REFERENCE QUANTITIES:
UNIT(RNU)       1000.       MODULE(RNM)     1000.     PART(RNP)     1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU)          27.0      MODULE(WM)         0.60   PART(WP)           0.029

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU)        0.625    MODULE(CUBEM)      0.025  PART(CUBEP)        0.0012

DEVELOPMENT PHASE, YEARS (YD)                  2.67
PRODUCTION PHASE, YEARS (YP)                   2.69
```

PRICE LIFE CYCLE COST

MA100 SEEKTALK LC: MC1

INPUT DATA

R&M DATA

MTBF	448.	MTTR-LRU	1.5	MTTR-MOD	3.0

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	23.	PARTS/LRU	188.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	10571.	12834.	0.	23405.
SUPPORT EQUIP	0.	2511.	2511.	5021.
MANPOWER	0.	0.	803.	803.
SUPPLY	0.	1567.	872.	2439.
SUPPLY ADM.	0.	12.	118.	130.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	108.	108.
TOTAL COST	10571.	16924.	4412.	31906.

AVAILABILITY

INHERENT	0.9870	OPERATIONAL	0.9870

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.415	0.017

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	40.	28.	32.
BALANCE CONSUMED	39.056	0.000	10.118

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 351.9
MA100 UHFAM RT

LC FILE INPUT DATA

MA100 UHFAM RT

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	2230.
LRU REPAIR TIME,HOURS(TF)	1.61
MODULE REPAIR TIME,HOURS(TMO)	3.27
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	2805.
MODULE COST,$(CMP)	1683.19
PART COST,$(CPP)	33.00
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	33.00
DEVELOPMENT COST,$(CEND)	403727.
NON-RECURRING PRODUCTION COST,$(CPE)	312212.
CONTRACTOR LRU REPAIR COST,$(CUR)	140.27
CONTRACTOR MODULE REPAIR COST,$(CMR)	589.12
MODULE TYPES,(P)	5.
PART TYPES,(PP)	115.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	48027.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	55845.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.02
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.18

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 6.0 MODULE(WM) 0.60 PART(WP) 0.012

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.167 MODULE(CUBEM) 0.033 PART(CUBEP) 0.0007

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.59

PRICE LIFE CYCLE COST

MA100 UHFAM RT LC: MC!

INPUT DATA

R&M DATA
MTBF 2230. MTTR-LRU 1.6 MTTR-MOD 3.3

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 5. PARTS/LRU 115.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	404.	3103.	0.	3507.
SUPPORT EQUIP	0.	1229.	1229.	2457.
MANPOWER	0.	0.	174.	174.
SUPPLY	0.	363.	0.	363.
SUPPLY ADM.	0.	6.	64.	70.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	5.	5.
TOTAL COST	404.	4702.	1471.	6577.

AVAILABILITY
INHERENT 0.9974 OPERATIONAL 0.9974

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.092	0.004

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	28.	28.	27.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 136.3
MA100 UHFAM RT

LC FILE INPUT DATA

MA100 VHFAM RT

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041

LRU MTBF,HOURS(MTBF)	1669.
LRU REPAIR TIME,HOURS(TF)	1.51
MODULE REPAIR TIME,HOURS(TMO)	3.06
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	3510.
MODULE COST,$(CMP)	1504.23
PART COST,$(CPP)	39.59
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	39.59
DEVELOPMENT COST,$(CEND)	491599.
NON-RECURRING PRODUCTION COST,$(CPE)	394093.
CONTRACTOR LRU REPAIR COST,$(CUR)	175.49
CONTRACTOR MODULE REPAIR COST,$(CMR)	526.48
MODULE TYPES,(P)	7.
PART TYPES,(PP)	118.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	53609.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	62336.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.13
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.32

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	7.0	MODULE(WM)	0.57	PART(WP)	0.015

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.188	MODULE(CUBEM)	0.027	PART(CUBEP)	0.0007

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.59

PRICE LIFE CYCLE COST

MA100 VHFAM RT LC: MC

INPUT DATA

R&M DATA

MTBF	1669.	MTTR-LRU	1.5	MTTR-MOD	3.1		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	7.	PARTS/LRU	118.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2

95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	492.	3886.	0.	4377.
SUPPORT EQUIP	0.	1371.	1371.	2743.
MANPOWER	0.	0.	221.	221.
SUPPLY	0.	461.	0.	461.
SUPPLY ADM.	0.	7.	67.	74.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	8.	8.
TOTAL COST	492.	5724.	1667.	7883.

AVAILABILITY

INHERENT	0.9965	OPERATIONAL	0.9965

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.114	0.005

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	30.	28.	27.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)

2= 100.0 1= 166.2

MA100 VHFFM RT

LC FILE INPUT DATA

MA100 VHFFM RT

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	2227.
LRU REPAIR TIME,HOURS(TF)	1.46
MODULE REPAIR TIME,HOURS(TMO)	3.00
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	2716.
MODULE COST,$(CMP)	1629.70
PART COST,$(CPP)	36.22
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	36.22
DEVELOPMENT COST,$(CEND)	394161.
NON-RECURRING PRODUCTION COST,$(CPE)	317415.
CONTRACTOR LRU REPAIR COST,$(CUR)	135.81
CONTRACTOR MODULE REPAIR COST,$(CMR)	570.40
MODULE TYPES,(P)	5.
PART TYPES,(PP)	105.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	47161.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	54838.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.16

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 5.0 MODULE(WM) 0.60 PART(WP) 0.013

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.125 MODULE(CUBEM) 0.025 PART(CUBEP) 0.0006

DEVELOPMENT PHASE, YEARS (YD) 1.50
PRODUCTION PHASE, YEARS (YP) 2.58

PRICE LIFE CYCLE COST

MA100 UHFFM RT LC: MC

INPUT DATA

R&M DATA
MTBF 2227. MTTR-LRU 1.5 MTTR-MOD 3.0

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 5. PARTS/LRU 105.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	394.	3020.	0.	3414
SUPPORT EQUIP	0.	1206.	1206.	2413
MANPOWER	0.	0.	163.	163
SUPPLY	0.	354.	0.	354
SUPPLY ADM.	0.	6.	59.	64
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	4.	4
TOTAL COST	394.	4586.	1432.	6413

AVAILABILITY
INHERENT 0.9974 OPERATIONAL 0.9974

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.084	0.004

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	28.	28.	27.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)
2= 100.0 1= 135.7
MA100 HF RT

LC FILE INPUT DATA

MA100 HF RT

DEPLOYMENT

EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	1107.
LRU REPAIR TIME,HOURS(TF)	1.50
MODULE REPAIR TIME,HOURS(TMO)	3.04
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	5000.
MODULE COST,$(CMP)	1500.04
PART COST,$(CPP)	48.39
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	48.39
DEVELOPMENT COST,$(CEND)	671079.
NON-RECURRING PRODUCTION COST,$(CPE)	541067.
CONTRACTOR LRU REPAIR COST,$(CUR)	250.01
CONTRACTOR MODULE REPAIR COST,$(CMR)	525.01
MODULE TYPES,(P)	10.
PART TYPES,(PP)	131.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	63713.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	74084.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.35
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.57

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	12.0	MODULE(WM)	0.60	PART(WP)	0.019

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.278	MODULE(CUBEM)	0.028	PART(CUBEP)	0.0009

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.61

PRICE LIFE CYCLE COST

MA100 HF PT LC: MC1

INPUT DATA

R&M DATA
MTBF 1107. MTTR-LRU 1.5 MTTR-MOD 3.0

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 10. PARTS/LRU 131.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	671.	5514.	0.	6185
SUPPORT EQUIP	0.	1630.	1630.	3260
MANPOWER	0.	0.	330.	330
SUPPLY	0.	657.	12.	669
SUPPLY ADM.	0.	8.	77.	84
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	20.	20
TOTAL COST	671.	7808.	2069.	10548

AVAILABILITY
INHERENT 0.9947 OPERATIONAL 0.9947

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.171	0.007

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	31.	28.	27.
BALANCE CONSUMED	1.243	0.000	0.000

COST/EFFECTIVENESS LIST (%)
2= 100.0 1= 225.8
MA100 TACAN

LC FILE INPUT DATA

MA100 TACAN

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	1105.
LRU REPAIR TIME,HOURS(TF)	1.35
MODULE REPAIR TIME,HOURS(TMO)	2.74
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	4900.
MODULE COST,$(CMP)	1469.90
PART COST,$(CPP)	70.00
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	70.00
DEVELOPMENT COST,$(CEND)	570066.
NON-RECURRING PRODUCTION COST,$(CPE)	543642.
CONTRACTOR LRU REPAIR COST,$(CUR)	244.98
CONTRACTOR MODULE REPAIR COST,$(CMR)	514.47
MODULE TYPES,(P)	10.
PART TYPES,(PP)	86.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	62928.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	73173.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.33
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.55

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	11.0	MODULE(WM)	0.60	PART(WP)	0.029

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.146	MODULE(CUBEM)	0.015	PART(CUBEP)	0.0007

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.60

PRICE LIFE CYCLE COST

MA100 TACAN LC: MC

INPUT DATA

R&M DATA
MTBF 1105. MTTR-LRU 1.3 MTTR-MOD 2.7

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 10. PARTS/LRU 86.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	570.	5417.	0.	5987
SUPPORT EQUIP	0.	1610.	1610.	3220
MANPOWER	0.	0.	305.	305
SUPPLY	0.	650.	41.	691
SUPPLY ADM.	0.	5.	54.	59
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	18.	18
TOTAL COST	570.	7682.	2027.	10279

AVAILABILITY
INHERENT 0.9947 OPERATIONAL 0.9947

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.154	0.006

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	31.	28.	30.
BALANCE CONSUMED	1.301	0.000	7.620

COST/EFFECTIVNESS LIST (%)
2= 100.0 '= 226.6
MA100 ILS VOR

LC FILE INPUT DATA

MA100 ILS VOR

DEPLOYMENT

EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	2156.
LRU REPAIR TIME,HOURS(TF)	1.50
MODULE REPAIR TIME,HOURS(TMO)	3.05
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	2481.
MODULE COST,$(CMP)	1488.53
PART COST,$(CPP)	36.31
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	36.31
DEVELOPMENT COST,$(CEND)	373960.
NON-RECURRING PRODUCTION COST,$(CPE)	286039.
CONTRACTOR LRU REPAIR COST,$(CUR)	124.04
CONTRACTOR MODULE REPAIR COST,$(CMR)	520.99
MODULE TYPES,(P)	5.
PART TYPES,(PP)	98.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	44006.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	51170.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.93
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.08

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	5.0	MODULE(WM)	0.60	PART(WP)	0.015

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.125	MODULE(CUBEM)	0.025	PART(CUBEP)	0.0006

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.53

PRICE LIFE CYCLE COST

MA100 ILS VOR LC: MC1

INPUT DATA

R&M DATA
MTBF 2158. MTTR-LRU 1.5 MTTR-MOD 3.1

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 5. PARTS/LRU 98.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	374.	2755.	0.	3129.
SUPPORT EQUIP	0.	1126.	1126.	2251.
MANPOWER	0.	0.	170.	170.
SUPPLY	0.	324.	0.	324.
SUPPLY ADM.	0.	6.	55.	61.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	4.	4.
TOTAL COST	374.	4210.	1355.	5939.

AVAILABILITY
INHERENT 0.9973 OPERATIONAL 0.9973

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.068	0.004

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	28.	28.	27.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 136.3
MA100 COM CRYP

LC FILE INPUT DATA

MA100 COM CRYP

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD)   2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	3263.
LRU REPAIR TIME,HOURS(TF)	1.43
MODULE REPAIR TIME,HOURS(TMD)	2.90
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	1898.
MODULE COST,$(CMP)	1423.45
PART COST,$(CPP)	49.08
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	49.08
DEVELOPMENT COST,$(CEND)	296413.
NON-RECURRING PRODUCTION COST,$(CPE)	234239.
CONTRACTOR LRU REPAIR COST,$(CUR)	94.90
CONTRACTOR MODULE REPAIR COST,$(CMR)	498.21
MODULE TYPES,(P)	4.
PART TYPES,(PP)	66.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	38703.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	45003.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.82
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.95

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	5.0	MODULE(WM)	0.50	PART(WP)	0.017

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.056	MODULE(CUBEM)	0.014	PART(CUBEP)	0.0005

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.54

PRICE LIFE CYCLE COST

MA100 COM CRYP LC: MC

INPUT DATA

R&M DATA

MTBF	3263.	MTTR-LRU	1.4	MTTR-MOD	2.9

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	4.	PARTS/LRU	66.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	296.	2123.	0.	2420.
SUPPORT EQUIP	0.	990.	990.	1980.
MANPOWER	0.	0.	108.	108.
SUPPLY	0.	253.	0.	253.
SUPPLY ADM.	0.	4.	38.	42
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	3.	3
TOTAL COST	296.	3370.	1139.	4806.

AVAILABILITY

INHERENT	0.9982	OPERATIONAL	0.9982

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.056	0.002

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	27.	28.	27.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 106.0
MA100 IFF TRANS

LC FILE INPUT DATA

MA100 IFF TRANS

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	1331.
LRU REPAIR TIME,HOURS(TF)	1.45
MODULE REPAIR TIME,HOURS(TMD)	2.94
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	4412.
MODULE COST,$(CMP)	1470.60
PART COST,$(CPP)	54.47
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	54.47
DEVELOPMENT COST,$(CEND)	601480.
NON-RECURRING PRODUCTION COST,$(CPE)	488120.
CONTRACTOR LRU REPAIR COST,$(CUR)	220.59
CONTRACTOR MODULE REPAIR COST,$(CMR)	514.71
MODULE TYPES,(P)	9.
PART TYPES,(PP)	112.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CPIM)	59951.
LRU+MODULE SUPPORT EQPT.,$(CPIP)	69711.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.27
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.48

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	12.0	MODULE(WM)	0.56	PART(WP)	0.021

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.188	MODULE(CUBEM)	0.021	PART(CUBEP)	0.0008

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.62

PRICE LIFE CYCLE COST

MA100 IFF TRANS LC: MC!

INPUT DATA

R&M DATA

MTBF	1331.	MTTR-LRU	1.5	MTTR-MOD	2.9

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	9.	PARTS/LRU	112.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	601.	4876.	0.	5478
SUPPORT EQUIP	0.	1534.	1534.	3067
MANPOWER	0.	0.	268.	268
SUPPLY	0.	586.	0.	586
SUPPLY ADM.	0.	7.	66.	73
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	16.	16
TOTAL COST	601.	7003.	1884.	9488

AVAILABILITY

INHERENT	0.9956	OPERATIONAL	0.9956

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.138	0.006

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	31.	28.	27.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 197.6
MA100 IFF INT

LC FILE INPUT DATA

MA100 IFF INT

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	475.
LRU REPAIR TIME,HOURS(TF)	1.33
MODULE REPAIR TIME,HOURS(TMO)	2.71
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	10174.
MODULE COST,$(CMP)	1327.03
PART COST,$(CPP)	102.08
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	102.08
DEVELOPMENT COST,$(CEND)	1250187.
NON-RECURRING PRODUCTION COST,$(CPE)	1109384.
CONTRACTOR LRU REPAIR COST,$(CUR)	508.70
CONTRACTOR MODULE REPAIR COST,$(CMR)	464.46
MODULE TYPES,(P)	21.
PART TYPES,(PP)	124.
FRACTION NON-STD.PARTS,(PNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	90994.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	105807.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.93
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	2.24

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 22.0 MODULE(WM) 0.61 PART(WP) 0.047

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.312 MODULE(CUBEM) 0.014 PART(CUBEP) 0.0010

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.65

PRICE LIFE CYCLE COST

MA100 IFF INT LC: MC!

INPUT DATA

R&M DATA
MTBF 475. MTTR-LRU 1.3 MTTR-MOD 2.7

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 21. PARTS/LRU 124.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	1250.	11214.	0.	12465.
SUPPORT EQUIP	0.	2328.	2328.	4656.
MANPOWER	0.	0.	697.	697.
SUPPLY	0.	1389.	830.	2220.
SUPPLY ADM.	0.	8.	84.	92.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	83.	83.
TOTAL COST	1250.	14940.	4022.	20212.

AVAILABILITY
INHERENT 0.9877 OPERATIONAL 0.9877

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.352	0.015

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	39.	28.	35.
BALANCE CONSUMED	35.617	0.000	25.272

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 423.6
MA100 IFF CRYP

LC FILE INPUT DATA

MA100 IFF CRYP

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	4456.
LRU REPAIR TIME,HOURS(TF)	1.66
MODULE REPAIR TIME,HOURS(TMO)	3.37
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	1525.
MODULE COST,$(CMP)	1524.55
PART COST,$(CPP)	69.30
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	69.30
DEVELOPMENT COST,$(CEND)	239324.
NON-RECURRING PRODUCTION COST,$(CPE)	198514.
CONTRACTOR LRU REPAIR COST,$(CUR)	76.23
CONTRACTOR MODULE REPAIR COST,$(CMR)	533.59
MODULE TYPES,(P)	3.
PART TYPES,(PP)	45.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	35329.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	41081.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.75
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.87

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 3.0 MODULE(WM) 0.50 PART(WP) 0.023

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.100 MODULE(CUBEM) 0.033 PART(CUBEP) 0.0015

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.55

PRICE LIFE CYCLE COST

MA100 IFF CRYP LC: MC

INPUT DATA

R&M DATA

MTBF	4456.	MTTR-LRU	1.7	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	3.	PARTS/LRU	45.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	239.	1671.	0.	1910.
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	16.	16.
SUPPLY	0.	322.	1349.	1672.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	3.	3.
TOTAL COST	239.	1993.	1369.	3601.

AVAILABILITY

INHERENT	0.9987	OPERATIONAL	0.9982

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	219.	0.	0.
BALANCE CONSUMED	747.173	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 113.6
MA100 INT TEST DUMMY

LC FILE INPUT DATA

MA100 INT TEST DUMMY

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD)   2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	3398.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	0.00
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	0.00
PART COST,$(CPP)	4.05
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	50.00
DEVELOPMENT COST,$(CEND)	3.
NON-RECURRING PRODUCTION COST,$(CPE)	25.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	0.00
MODULE TYPES,(P)	0.
PART TYPES,(PP)	1.
FRACTION NON-STD.PARTS,(FNSP)	1.00
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	0.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.00

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.000	PART(EPP)	0.951

REFERENCE QUANTITIES:

UNIT(RNU)	1.	MODULE(RNM)	1.	PART(RNP)	1.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.00	PART(WP)	0.030

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.000	PART(CUBEP)	0.0010

DEVELOPMENT PHASE, YEARS (YD)	0.89
PRODUCTION PHASE, YEARS (YP)	0.79

PRICE LIFE CYCLE COST

MA100 INT TEST DUMMY LC: MC1

INPUT DATA

R&M DATA

MTBF	3398.	MTTR-LRU	0.0	MTTR-MOD	0.0

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	0.	PARTS/LRU	1.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 30
ON-EQUIPMENT REPAIR TO NON-REPAIRABLE PART.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	0.	2.	0.	2.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	17.	17.
SUPPLY	0.	35.	0.	35.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	0.	38.	18.	56.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	0.	1156.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
30= 100.0

ARCHITECTURE THREE

LC FILE INPUT DATA

MA300 RF MOD1 DUAL GPS PREAMP

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	16568.
LRU REPAIR TIME,HOURS(TR)	0.00
MODULE REPAIR TIME,HOURS(TMD)	3.19
LRU PER SYSTEM,(EE)	5.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	282.61
PART COST,$(CPP)	13.90
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	13.90
DEVELOPMENT COST,$(CEND)	174758.
NON-RECURRING PRODUCTION COST,$(CPE)	371725.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	296.74
MODULE TYPES,(P)	1.
PART TYPES,(PP)	32.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	23399.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.50

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.927	PART(EPP)	0.964

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	5000.	PART(RNP)	5000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.40	PART(WP)	0.007

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0003

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	3.29

PRICE LIFE CYCLE COST

MA300 RF MOD1 DUAL GPS PREAMP LC: MC3

INPUT DATA

R&M DATA
  MTBF 16568. MTTR-LRU 0.0 MTTR-MOD 3.2

DEPLOYMENT
  EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
  LRUS/EQUIP 5. MODS/LRU 1. PARTS/LRU 32.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
  EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
  ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	175.	1748.	0.	1923.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	18.	18.
SUPPLY	0.	345.	0.	345.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0
TOTAL COST	175.	2093.	19.	2287

AVAILABILITY
INHERENT 1.0000 OPERATIONAL 1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1254.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)
 1= 100.0 2= 146.3
 MA7[illegible] RF MOD6 GPS LO SYNTH

LC FILE INPUT DATA

MA300 RF MOD6 GPS LO SYNTH

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	16601.
LRU REPAIR TIME,HOURS(TP)	0.00
MODULE REPAIR TIME,HOURS(TMD)	3.20
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	504.96
PART COST,$(CPP)	10.03
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	10.03
DEVELOPMENT COST,$(CEND)	123269.
NON-RECURRING PRODUCTION COST,$(CPE)	90777.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	530.21
MODULE TYPES,(P)	1.
PART TYPES,(PP)	69.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	23496.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.50

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.939	PART(EPP)	0.570

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.40	PART(WP)	0.003

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.021	PART(CUBEP)	0.0001

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.48

PRICE LIFE CYCLE COST

MA300 RF MOD6 GPS LO SYNTH LC: MC

INPUT DATA

R&M DATA

MTBF	16601.	MTTR-LRU	0.0	MTTR-MOD	3.2		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	69.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	123.	559.	0.	682
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	4.	4
SUPPLY	0.	505.	0.	505
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	0.	0
TOTAL COST	123.	1064.	5.	1192

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1080.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 189.6
MA300 RF MOD7 L DUAL FT PREAMP

LC FILE INPUT DATA

MA300 RF MOD7 L DUAL FT PREAMP

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	16387.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.17
LRU PER SYSTEM,(EE)	3.
LRU COST,$(CUF)	0.
MODULE COST,$(CMF)	320.65
PART COST,$(CPF)	15.77
PART COST ON-EQUIPMENT REPAIR,$(CPFE)	15.77
DEVELOPMENT COST,$(CEND)	127651.
NON-RECURRING PRODUCTION COST,$(CPE)	231067.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	336.68
MODULE TYPES,(P)	1.
PART TYPES,(PP)	29.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	22866.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.48

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.000 MODULE(EMP) 0.929 PART(EPP) 0.965

REFERENCE QUANTITIES:
UNIT(RNU) 0. MODULE(RNM) 3000. PART(RNP) 3000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 0.0 MODULE(WM) 0.40 PART(WP) 0.007

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.000 MODULE(CUBEM) 0.020 PART(CUBEP) 0.0003

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.98

PRICE LIFE CYCLE COST

MA300 RF MOD7 L DUAL FT PREAMP LC: MC

INPUT DATA

R&M DATA

MTBF	16387.	MTTR-LRU	0.0	MTTR-MOD	3.2		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	3.	MODS/LRU	1.	PARTS/LRU	29.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	128.	1157.	0.	1285
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	11.	11.
SUPPLY	0.	362.	0.	362.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	128.	1519.	12.	1659.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1172.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)
1= 100.0 2= 161.8
MA300 RF MOD8 L DUALT PREAMP

LC FILE INPUT DATA

MA300 RF MODS L DUALT PREAMP

```
DEPLOYMENT
EQUIPS(ED)     1000. ORGANIZATION(OD)    0. INTERMEDIATE(DI) 30. DEPOT(DD)  2.

DURATION OF SUPPORT PERIOD,YEARS(YR)                10.00
ON-TIME FRACTION(OTF)                                .041

LRU MTBF,HOURS(MTBF)                              13008.
LRU REPAIR TIME,HOURS(TP)                            0.00
MODULE REPAIR TIME,HOURS(TMO)                        3.05
LRU PER SYSTEM,(EE)                                  4.
LRU COST,$(CUP)                                      0.
MODULE COST,$(CMP)                                 336.39
PART COST,$(CPP)                                     9.80
PART COST ON-EQUIPMENT REPAIR,$(CPPE)                9.80
DEVELOPMENT COST,$(CEND)                         173701.
NON-RECURRING PRODUCTION COST,$(CPE)             329065.
CONTRACTOR LRU REPAIR COST,$(CUR)                    0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)               353.21
MODULE TYPES,(P)                                     1.
PART TYPES,(PP)                                     47.
FRACTION NON-STD.PARTS,(FNSP)                        0.50
LRU SUPPORT EQPT. COST,$(CFIM)                       0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)                 24269.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)                   0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)            0.51


COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP)          0.000    MODULE(EMP)         0.928  PART(EPP)          0.964

REFERENCE QUANTITIES:
UNIT(RNU)          0.       MODULE(RNM)      4000.     PART(RNP)     4000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU)           0.0      MODULE(WM)          0.50   PART(WP)           0.005

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU)        0.000    MODULE(CUBEM)       0.020  PART(CUBEP)        0.0002

DEVELOPMENT PHASE, YEARS (YD)                   1.58
PRODUCTION PHASE, YEARS (YP)                    3.12
```

PRICE LIFE CYCLE COST

MA300 RF MODS L DUALT PREAMP LC: MC3

INPUT DATA

R&M DATA
MTBF 13008. MTTR-LRU 0.0 MTTR-MOD 3.1

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 4. MODS/LRU 1. PARTS/LRU 47.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	174.	1632.	0.	1806.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	18.	18.
SUPPLY	0.	410.	0.	410.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	174.	2042.	19.	2235.

AVAILABILITY
INHERENT 1.0000 OPERATIONAL 1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1258.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 148.8
MA300 RF MOD12 ANT SEL

LC FILE INPUT DATA

MA300 RF MOD12 ANT SEL

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	22259.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.36
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	410.81
PART COST,$(CPP)	24.17
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	24.17
DEVELOPMENT COST,$(CEND)	99556.
NON-RECURRING PRODUCTION COST,$(CPE)	81260.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	431.35
MODULE TYPES,(P)	1.
PART TYPES,(PP)	33.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	21301.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.45

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.006

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.021	PART(CUBEP)	0.0004

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.49

PRICE LIFE CYCLE COST

MA300 RF MOD12 ANT SEL LC: MC3

INPUT DATA

R&M DATA

MTBF	22259.	MTTR-LRU	0.0	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	33.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	100.	462.	0.	562.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	3.	3.
SUPPLY	0.	407.	0.	407.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	100.	869.	4.	972.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1068.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 198.7
MA300 RF MOD25 TDM CPLR

LC FILE INPUT DATA

MA300 RF MOD25 TDM CPLR

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	67957.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMD)	3.10
LRU PER SYSTEM,(EE)	5.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	102.83
PART COST,$(CPP)	9.95
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	9.95
DEVELOPMENT COST,$(CEND)	95284.
NON-RECURRING PRODUCTION COST,$(CPE)	193660.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	107.97
MODULE TYPES,(P)	1.
PART TYPES,(PP)	26.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	14397.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.30

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.927	PART(EPP)	0.964

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	5000.	PART(RNP)	5000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.10	PART(WP)	0.003

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.010	PART(CUBEP)	0.0003

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	3.29

PRICE LIFE CYCLE COST

MA300 RF MOD25 TDM CPLR LC: MC

INPUT DATA

R&M DATA
MTBF 67957. MTTR-LRU 0.0 MTTR-MOD 3.1

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 5. MODS/LRU 1. PARTS/LRU 26.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	95.	696.	0.	791
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	4.	4
SUPPLY	0.	110.	0.	110
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	0.	0
TOTAL COST	95.	806.	5.	906

AVAILABILITY
INHERENT 1.0000 OPERATIONAL 1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1090.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 172.8
MA300 RF MOD30 BITE CPLR

LC FILE INPUT DATA

MA300 RF MOD30 BITE CPLR

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	27181.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.12
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	334.59
PART COST,$(CPP)	38.61
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	38.61
DEVELOPMENT COST,$(CEND)	90272.
NON-RECURRING PRODUCTION COST,$(CPE)	70714.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	351.32
MODULE TYPES,(P)	1.
PART TYPES,(PP)	31.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	19477.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.41

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP)   0.000   MODULE(EMP)   0.939 PART(EPP)   0.970

REFERENCE QUANTITIES:
UNIT(RNU)   0.   MODULE(RNM)   1000.   PART(RNP)   1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU)   0.0   MODULE(WM)   0.25   PART(WP)   0.010

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU)   0.000   MODULE(CUBEM)   0.010 PART(CUBEP)   0.0004

DEVELOPMENT PHASE, YEARS (YD)   1.50
PRODUCTION PHASE, YEARS (YP)   2.48

PRICE LIFE CYCLE COST

MA300 RF MOD30 BITE CPLR LC: MC

INPUT DATA

R&M DATA
MTBF 27181. MTTR-LRU 0.0 MTTR-MOD 3.1

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 1. PARTS/LRU 21.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	90.	381.	0.	471
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	2.	2
SUPPLY	0.	329.	0.	329
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	0.	0
TOTAL COST	90.	710.	3.	804

AVAILABILITY
INHERENT 1.0000 OPERATIONAL 1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1061.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 208.9
MA300 RF MOD31 BITE IO COMP

LC FILE INPUT DATA

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MA300 RF MOD31 BITE IO COMP

DEPLOYMENT
EQUIPS(ED)     1000. ORGANIZATION(OD)    0. INTERMEDIATE(DI) 20. DEPOT(DD)  3.

DURATION OF SUPPORT PERIOD,YEARS(YR)                    10.00
ON-TIME FRACTION(OTF)                                    .041

LRU MTBF,HOURS(MTBF)                                  13586.
LRU REPAIR TIME,HOURS(TP)                                0.00
MODULE REPAIR TIME,HOURS(TMD)                            3.12
LRU PER SYSTEM,(EE)                                      1.
LRU COST,$(CUP)                                          0.
MODULE COST,$(CMP)                                     611.44
PART COST,$(CPP)                                        30.07
PART COST ON-EQUIPMENT REPAIR,$(CPPE)                   30.07
DEVELOPMENT COST,$(CEND)                              147150.
NON-RECURRING PRODUCTION COST,$(CPE)                  107697.
CONTRACTOR LRU REPAIR COST,$(CUR)                        0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)                   642.01
MODULE TYPES,(P)                                         1.
PART TYPES,(PP)                                         40.
FRACTION NON-STD.PARTS,(FNSP)                            0.50
LRU SUPPORT EQPT. COST,$(CPIU)                           0.
LRU+MODULE SUPPORT EQPT.,$(CPIP)                      26334.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)                       0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)                0.56


COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP)          0.000    MODULE(EMP)        0.939  PART(EPP)          0.970

REFERENCE QUANTITIES:
UNIT(RNU)          0.       MODULE(RNM)     1000.     PART(RNP)      1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU)           0.0      MODULE(WM)         0.50   PART(WP)           0.008

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU)        0.000    MODULE(CUBEM)      0.021  PART(CUBEP)        0.0003

DEVELOPMENT PHASE, YEARS (YD)                  1.50
PRODUCTION PHASE, YEARS (YP)                   2.52
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AD-A082 956 GENERAL DYNAMICS SAN DIEGO CALIF ELECTRONICS DIV F/G 17/2.1
MULTIFUNCTION MULTIBAND AIRBORNE RADIO SYSTEM MFBARS.(U)
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UNCLASSIFIED R-78-055 NL

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PRICE LIFE CYCLE COST

MA300 RF MOD31 BITE IO COMP LC: MC

INPUT DATA

R&M DATA

MTBF	13586.	MTTR-LRU	0.0	MTTR-MOD	3.1

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	40.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	147.	674.	0.	821
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	4.	4
SUPPLY	0.	617.	0.	617
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	0.	0
TOTAL COST	147.	1291.	5.	1444

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1090.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)
1= 100.0 2= 181.5
MA300 RF MOD36 FREQ REF

LC FILE INPUT DATA

MA300 RF MOD36 FREQ REF

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	11073.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.35
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	531.70
PART COST,$(CPP)	22.04
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	22.04
DEVELOPMENT COST,$(CEND)	191954.
NON-RECURRING PRODUCTION COST,$(CPE)	222989.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	547.79
MODULE TYPES,(P)	1.
PART TYPES,(PP)	44.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CPIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CPIP)	27671.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.59

COST-QUANTITY EXPONENTS (LEARNING FACTORS):					
UNIT(EUP)	0.000	MODULE(EMP)	0.931	PART(EPP)	0.966
REFERENCE QUANTITIES:					
UNIT(RNU)	0.	MODULE(RNM)	2000.	PART(RNP)	2000.
SHIPPING WEIGHT, POUNDS:					
UNIT(WU)	0.0	MODULE(WM)	0.60	PART(WP)	0.006
STORAGE CUBES, CUBIC FEET:					
UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.042	PART(CUBEP)	0.000

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.82

PRICE LIFE CYCLE COST

MA300 RF MOD36 FREQ REF LC: MC3

INPUT DATA

R&M DATA

MTBF	11073.	MTTR-LRU	0.0	MTTR-MOD	3.3		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	2.	MODS/LRU	1.	PARTS/LRU	44.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	192.	1232.	0.	1424.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	11.	11.
SUPPLY	0.	590.	0.	590.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	192.	1823.	12.	2026.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1169.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 160.6
MA300 INT TEST

LC FILE INPUT DATA

MA300 INT TEST

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	2060.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	0.00
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	0.00
PART COST,$(CPP)	1206.54
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	50.00
DEVELOPMENT COST,$(CEND)	192905.
NON-RECURRING PRODUCTION COST,$(CPE)	136566.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	0.00
MODULE TYPES,(P)	0.
PART TYPES,(PP)	1.
FRACTION NON-STD.PARTS,(FNSP)	1.00
LRU SUPPORT EQPT. COST,$(CPIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CPIP)	0.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.00

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.000 MODULE(EMP) 0.000 PART(EPP) 0.996

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 0.0 MODULE(WM) 0.00 PART(WP) 0.030

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.000 MODULE(CUBEM) 0.000 PART(CUBEP) 0.001

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.29

PRICE LIFE CYCLE COST

MA300 INT TEST LC: MC

INPUT DATA

R&M DATA

MTBF	2060.	MTTR-LRU	0.0	MTTR-MOD	0.0		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	0.	PARTS/LRU	1.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 30
ON-EQUIPMENT REPAIR TO NON-REPAIRABLE PART:

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	193.	1206.	0.	1399.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	29.	29.
SUPPLY	0.	54.	24.	79.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	193.	1260.	54.	1507.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	0.	1232.
BALANCE CONSUMED	0.000	0.000	512.655

COST/EFFECTIVNESS LIST (%)
30= 100.0

LC FILE INPUT DATA

MA300 RF MOD2 ELE WTG CORR

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	1085.
LRU REPAIR TIME,HOURS(TF)	1.44
MODULE REPAIR TIME,HOURS(TMO)	2.92
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	4039.
MODULE COST,$(CMP)	1211.77
PART COST,$(CPP)	75.74
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	75.74
DEVELOPMENT COST,$(CEND)	1503719.
NON-RECURRING PRODUCTION COST,$(CPE)	821769.
CONTRACTOR LRU REPAIR COST,$(CUR)	201.96
CONTRACTOR MODULE REPAIR COST,$(CMR)	424.12
MODULE TYPES,(P)	6.
PART TYPES,(PP)	43.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	59797.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	69531.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.27
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.47

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 2000. MODULE(RNM) 2000. PART(RNP) 2000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 8.0 MODULE(WM) 0.60 PART(WP) 0.038

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.187 MODULE(CUBEM) 0.019 PART(CUBEP) 0.0012

DEVELOPMENT PHASE, YEARS (YD) 3.00
PRODUCTION PHASE, YEARS (YP) 2.89

PRICE LIFE CYCLE COST

MA300 RF MOD2 ELE WTG CORR LC: MC

INPUT DATA

R&M DATA
MTBF 1065. MTTR-LRU 1.4 MTTR-MOD 2.9

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 2. MODS/LRU 6. PARTS/LRU 43.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	1504.	8872.	0.	10376
SUPPORT EQUIP	0.	1530.	1530.	3059
MANPOWER	0.	0.	652.	652
SUPPLY	0.	459.	432.	892
SUPPLY ADM.	0.	3.	29.	31
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	27.	27
TOTAL COST	1504.	10864.	2669.	1503?

AVAILABILITY
INHERENT 0.9892 OPERATIONAL 0.989?

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.335	0.014

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	39.	31.	48.
BALANCE CONSUMED	26.787	0.000	105.237

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 267.0
MA300 RF MOD3 GPS FN CORR

LC FILE INPUT DATA

MA300 RF MOD3 GPS PN CORR

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	10666.
LRU REPAIR TIME,HOURS(TF)	1.47
MODULE REPAIR TIME,HOURS(TMO)	2.98
LRU PER SYSTEM,(EE)	5.
LRU COST,$(CUP)	413.
MODULE COST,$(CMP)	618.99
PART COST,$(CPP)	19.97
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	19.97
DEVELOPMENT COST,$(CEND)	740473.
NON-RECURRING PRODUCTION COST,$(CPE)	514183.
CONTRACTOR LRU REPAIR COST,$(CUR)	20.63
CONTRACTOR MODULE REPAIR COST,$(CMR)	216.65
MODULE TYPES,(P)	2.
PART TYPES,(PP)	38.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	24369.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	28336.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.52
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.60

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.854 MODULE(EMP) 0.927 PART(EPP) 0.964

REFERENCE QUANTITIES:
UNIT(RNU) 5000. MODULE(RNM) 5000. PART(RNP) 5000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 1.3 MODULE(WM) 0.31 PART(WP) 0.010

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.020 MODULE(CUBEM) 0.010 PART(CUBEP) 0.000

DEVELOPMENT PHASE, YEARS (YD)	3.08
PRODUCTION PHASE, YEARS (YP)	3.34

PRICE LIFE CYCLE COST

MA300 RF MOD3 GPS PN CORR LC: MC

INPUT DATA

R&M DATA

MTBF	10686.	MTTR-LRU	1.5	MTTR-MOD	3.0

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	5.	MODS/LRU	2.	PARTS/LRU	38.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	740.	2544.	0.	3284.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	33.	33.
SUPPLY	0.	173.	962.	1135.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	3.	3.
TOTAL COST	740.	2717.	998.	4456.

AVAILABILITY

INHERENT	0.9972	OPERATIONAL	0.9916

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	427.	0.	0.
BALANCE CONSUMED	1587.580	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 107.7
MA300 RF MOD4 VAR FREQ IF

LC FILE INPUT DATA

MA300 RF MOD4 VAR FREQ IF

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	7419.
LRU REPAIR TIME,HOURS(TF)	1.39
MODULE REPAIR TIME,HOURS(TMD)	2.82
LRU PER SYSTEM,(EE)	17.
LRU COST,$(CUP)	319.
MODULE COST,$(CMP)	478.11
PART COST,$(CPP)	9.37
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	9.37
DEVELOPMENT COST,$(CEND)	718751.
NON-RECURRING PRODUCTION COST,$(CPE)	2744064.
CONTRACTOR LRU REPAIR COST,$(CUR)	15.94
CONTRACTOR MODULE REPAIR COST,$(CMR)	167.34
MODULE TYPES,(P)	2.
PART TYPES,(PP)	54.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	28165.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	32750.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.60
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.69

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.834	MODULE(EMP)	0.917	PART(EPP)	0.959

REFERENCE QUANTITIES:

UNIT(RNU)	17000.	MODULE(RNM)	17000.	PART(RNP)	17000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	1.5	MODULE(WM)	0.45	PART(WP)	0.009

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.021	MODULE(CUBEM)	0.010	PART(CUBEP)	0.0002

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	4.25

PRICE LIFE CYCLE COST

MA300 RF MOD4 VAR FREQ IF LC: MC3

INPUT DATA

R&M DATA

MTBF	7419.	MTTR-LRU	1.4	MTTR-MOD	2.8

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	17.	MODS/LRU	2.	PARTS/LRU	54.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2

95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	719.	8164.	0.	8883.
SUPPORT EQUIP	0.	721.	721.	1441.
MANPOWER	0.	0.	790.	790.
SUPPLY	0.	64.	97.	161.
SUPPLY ADM.	0.	3.	30.	33.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	6.	6.
TOTAL COST	719.	8951.	1644.	11314.

AVAILABILITY

INHERENT	0.9866	OPERATIONAL	0.9866

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.404	0.017

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	42.	40.	48.
BALANCE CONSUMED	40.158	1.079	104.388

COST/EFFECTIVNESS LIST (%)

2= 100.0 1= 121.6

MA300 RF MOD5 70 MHZ IF

LC FILE INPUT DATA

MA300 RF MOD5 70 MHZ IF

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(DO) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	7286.
LRU REPAIR TIME,HOURS(TF)	1.38
MODULE REPAIR TIME,HOURS(TMD)	2.80
LRU PER SYSTEM,(EE)	17.
LRU COST,$(CUP)	302.
MODULE COST,$(CMP)	453.48
PART COST,$(CPP)	8.89
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	8.89
DEVELOPMENT COST,$(CEND)	694984.
NON-RECURRING PRODUCTION COST,$(CPE)	2593299.
CONTRACTOR LRU REPAIR COST,$(CUR)	15.12
CONTRACTOR MODULE REPAIR COST,$(CMR)	158.72
MODULE TYPES,(P)	2.
PART TYPES,(PP)	54.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	27045.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	31448.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.57
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.67

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.834 MODULE(EMP) 0.917 PART(EPP) 0.959

REFERENCE QUANTITIES:
UNIT(RNU) 17000. MODULE(RNM) 17000. PART(RNP) 17000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 1.5 MODULE(WM) 0.45 PART(WP) 0.009

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.021 MODULE(CUBEM) 0.010 PART(CUBEP) 0.0002

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	4.20

PRICE LIFE CYCLE COST

MA300 RF MOD5 70 MHZ IF LC: MC3

INPUT DATA

R&M DATA
MTBF 7286. MTTR-LRU 1.4 MTTR-MOD 2.8

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 17. MODS/LRU 2. PARTS/LRU 54.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	695.	7724.	0.	8419.
SUPPORT EQUIP	0.	692.	692.	1384.
MANPOWER	0.	0.	800.	800.
SUPPLY	0.	60.	96.	157.
SUPPLY ADM.	0.	3.	30.	33.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	6.	6.
TOTAL COST	695.	8480.	1625.	10799.

AVAILABILITY
INHERENT 0.9863 OPERATIONAL 0.9863

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.409	0.017

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	42.	40.	48.
BALANCE CONSUMED	41.656	1.828	107.167

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 121.6
MA300 RF MOD9 L ELE WTG

LC FILE INPUT DATA

MA300 RF MOD9 L ELE WTG

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	944.
LRU REPAIR TIME,HOURS(TF)	1.33
MODULE REPAIR TIME,HOURS(TMD)	2.71
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	3674.
MODULE COST,$(CMP)	1002.03
PART COST,$(CPP)	62.63
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	62.63
DEVELOPMENT COST,$(CEND)	1461356.
NON-RECURRING PRODUCTION COST,$(CPE)	360298.
CONTRACTOR LRU REPAIR COST,$(CUR)	183.70
CONTRACTOR MODULE REPAIR COST,$(CMR)	350.71
MODULE TYPES,(P)	7.
PART TYPES,(PP)	52.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	46791.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	54408.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.99
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.15

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 12.0 MODULE(WM) 0.73 PART(WP) 0.045

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.250 MODULE(CUBEM) 0.023 PART(CUBEP) 0.0014

DEVELOPMENT PHASE, YEARS (YD)	2.83
PRODUCTION PHASE, YEARS (YP)	2.32

PRICE LIFE CYCLE COST

MA300 RF MOD9 L ELE WTG LC: MC:

INPUT DATA

R&M DATA

MTBF	944.	MTTR-LRU	1.3	MTTR-MOD	2.7			

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	7.	PARTS/LRU	52.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	1461.	4014.	0.	5475.
SUPPORT EQUIP	0.	1197.	1197.	2394.
MANPOWER	0.	0.	353.	353.
SUPPLY	0.	377.	114.	491.
SUPPLY ADM.	0.	3.	34.	37.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	23.	23.
TOTAL COST	1461.	5591.	1720.	8773.

AVAILABILITY

INHERENT	0.9938	OPERATIONAL	0.9938

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.178	0.007

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	32.	29.	36.
BALANCE CONSUMED	5.776	0.000	36.762

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 232.1
MA300 RF MOD10 FHOP SYNTH

LC FILE INPUT DATA

MA300 RF MOD10 FHOP SYNTH

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	6602.
LRU REPAIR TIME,HOURS(TF)	1.52
MODULE REPAIR TIME,HOURS(TMD)	3.08
LRU PER SYSTEM,(EE)	0.
LRU COST,$(CUP)	797.
MODULE COST,$(CMP)	1194.97
PART COST,$(CPP)	8.47
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	8.47
DEVELOPMENT COST,$(CEND)	451918.
NON-RECURRING PRODUCTION COST,$(CPE)	304364.
CONTRACTOR LRU REPAIR COST,$(CUR)	39.83
CONTRACTOR MODULE REPAIR COST,$(CMR)	418.24
MODULE TYPES,(P)	2.
PART TYPES,(PP)	111.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	29144.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	33888.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.62
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.72

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.862	MODULE(EMP)	0.931	PART(EPP)	0.966

REFERENCE QUANTITIES:

UNIT(RNU)	2000.	MODULE(RNM)	2000.	PART(RNP)	2000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	2.0	MODULE(WM)	0.50	PART(WP)	0.004

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.042	MODULE(CUBEM)	0.021	PART(CUBEP)	0.0001

DEVELOPMENT PHASE, YEARS (YD)	2.08
PRODUCTION PHASE, YEARS (YP)	2.83

PRICE LIFE CYCLE COST

MA300 RF MOD10 FHOP SYNTH LC: MC:

INPUT DATA

R&M DATA

MTBF	6602.	MTTR-LRU	1.5	MTTR-MOD	3.1

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	0.	MODS/LRU	2.	PARTS/LRU	111.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	452.	304.	0.	756.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	0.	0.
SUPPLY	0.	0.	0.	0.
SUPPLY ADM.	0.	0.	0.	0.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	452.	304.	0.	756.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	0.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 100.0
MA300 RF MOD11 SHOP SYNTH

LC FILE INPUT DATA

MA300 RF MOD11 SHOP SYNTH

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(DO) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	6932.
LRU REPAIR TIME,HOURS(TF)	1.55
MODULE REPAIR TIME,HOURS(TMO)	3.15
LRU PER SYSTEM,(EE)	10.
LRU COST,$(CUP)	546.
MODULE COST,$(CMP)	819.27
PART COST,$(CPP)	13.43
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	13.43
DEVELOPMENT COST,$(CEND)	608285.
NON-RECURRING PRODUCTION COST,$(CPE)	1581194.
CONTRACTOR LRU REPAIR COST,$(CUR)	27.31
CONTRACTOR MODULE REPAIR COST,$(CMR)	286.74
MODULE TYPES,(P)	2.
PART TYPES,(PP)	62.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	32454.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	37738.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.69
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.80

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.848 MODULE(EMP) 0.924 PART(EPP) 0.962

REFERENCE QUANTITIES:
UNIT(RNU) 10000. MODULE(RNM) 10000. PART(RNP) 10000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 2.0 MODULE(WM) 0.50 PART(WP) 0.008

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.042 MODULE(CUBEM) 0.021 PART(CUBEP) 0.0003

DEVELOPMENT PHASE, YEARS (YD) 1.58
PRODUCTION PHASE, YEARS (YP) 3.95

PRICE LIFE CYCLE COST

MA300 RF MOD11 SHOP SYNTH LC: MC

INPUT DATA

R&M DATA
MTBF 6932. MTTR-LRU 1.5 MTTR-MOD 3.2

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 10. MODS/LRU 2. PARTS/LRU 62.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	608.	7037.	0.	7645
SUPPORT EQUIP	0.	830.	830.	1660
MANPOWER	0.	0.	544.	544
SUPPLY	0.	92.	61.	153
SUPPLY ADM.	0.	3.	34.	37
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	5.	5
TOTAL COST	608.	7963.	1475.	10046

AVAILABILITY
INHERENT 0.9915 OPERATIONAL 0.9915

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.284	0.012

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	35.	35.	38.
BALANCE CONSUMED	16.720	0.000	45.554

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 121.3
MA300 RF MOD14 L TRAN

LC FILE INPUT DATA

MA300 RF MOD14 L TRAN

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	3398.
LRU REPAIR TIME,HOURS(TF)	1.51
MODULE REPAIR TIME,HOURS(TMO)	3.06
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	2442.
MODULE COST,$(CMP)	1631.52
PART COST,$(CPP)	29.07
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	29.07
DEVELOPMENT COST,$(CEND)	865024.
NON-RECURRING PRODUCTION COST,$(CPE)	276824.
CONTRACTOR LRU REPAIR COST,$(CUR)	122.10
CONTRACTOR MODULE REPAIR COST,$(CMR)	641.03
MODULE TYPES,(P)	4.
PART TYPES,(PP)	110.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	45088.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	52428.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.95
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.11

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	9.0	MODULE(WM)	0.50	PART(WP)	0.008

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.104	MODULE(CUBEM)	0.026	PART(CUBEP)	0.0004

DEVELOPMENT PHASE, YEARS (YD)	2.17
PRODUCTION PHASE, YEARS (YP)	2.64

PRICE LIFE CYCLE COST

LC: MC3

MA300 RF MOD14 L TRAN

INPUT DATA

R&M DATA
MTBF 3396. MTTR-LRU 1.5 MTTR-MOD 3.1

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 4. PARTS/LRU 110.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	865.	2707.	0.	3572.
SUPPORT EQUIP	0.	1153.	1153.	2307.
MANPOWER	0.	0.	109.	109.
SUPPLY	0.	308.	0.	308.
SUPPLY ADM.	0.	6.	60.	66.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	5.	5.
TOTAL COST	865.	4174.	1327.	6366.

AVAILABILITY
INHERENT 0.9983 OPERATIONAL 0.9983

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.056	0.002

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	27.	28.	24.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)
2= 100.0 1= 108.2
MA300 RF MOD15 UHF DUALT PREAMP

LC FILE INPUT DATA

MA300 RF MOD15 UHF DUALT PREAMP

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	10562.
LRU REPAIR TIME,HOURS(TF)	1.46
MODULE REPAIR TIME,HOURS(TMO)	2.96
LRU PER SYSTEM,(EE)	5.
LRU COST,$(CUP)	396.
MODULE COST,$(CMP)	594.34
PART COST,$(CPP)	9.74
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	9.74
DEVELOPMENT COST,$(CEND)	219957.
NON-RECURRING PRODUCTION COST,$(CPE)	469280.
CONTRACTOR LRU REPAIR COST,$(CUR)	19.81
CONTRACTOR MODULE REPAIR COST,$(CMR)	208.02
MODULE TYPES,(P)	2.
PART TYPES,(PP)	48.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	23752.
LRU+MODULE SUPPORT EQPT.,$(CFIF)	27619.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.50
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.58

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.854	MODULE(EMP)	0.927	PART(EPP)	0.964

REFERENCE QUANTITIES:

UNIT(RNU)	5000.	MODULE(RNM)	5000.	PART(RNP)	5000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	1.3	MODULE(WM)	0.31	PART(WP)	0.005

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.020	MODULE(CUBEM)	0.010	PART(CUBEP)	0.0002

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	3.30

PRICE LIFE CYCLE COST

MA300 RF MOD15 UHF DUALT PREAMP LC: MC3

INPUT DATA

R&M DATA

MTBF	10562.	MTTR-LRU	1.5	MTTR-MOD	3.0

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	5.	MODS/LRU	2.	PARTS/LRU	46.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	220.	2435.	0.	2655.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	33.	33.
SUPPLY	0.	168.	931.	1099.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	3.	3.
TOTAL COST	220.	2603.	968.	3791.

AVAILABILITY

INHERENT	0.9972	OPERATIONAL	0.9919

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	432.	0.	0.
BALANCE CONSUMED	1606.378	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 109.1
MA300 RF MOD16 UHF WTG

LC FILE INPUT DATA

MA300 RF MOD16 UHF WTG

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	1065.
LRU REPAIR TIME,HOURS(TF)	1.38
MODULE REPAIR TIME,HOURS(TMO)	2.81
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	4601.
MODULE COST,$(CMP)	1380.18
PART COST,$(CPP)	86.26
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	86.26
DEVELOPMENT COST,$(CEND)	1232635.
NON-RECURRING PRODUCTION COST,$(CPE)	465855.
CONTRACTOR LRU REPAIR COST,$(CUR)	230.03
CONTRACTOR MODULE REPAIR COST,$(CMR)	483.06
MODULE TYPES,(P)	6.
PART TYPES,(PP)	43.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	59797.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	69531.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	1.27
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	1.47

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.878 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 1000. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 8.0 MODULE(WM) 0.60 PART(WP) 0.038

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.146 MODULE(CUBEM) 0.015 PART(CUBEP) 0.0009

DEVELOPMENT PHASE, YEARS (YD)	3.00
PRODUCTION PHASE, YEARS (YP)	2.57

PRICE LIFE CYCLE COST

MA300 RF MOD16 UHF WTG LC: MC31

INPUT DATA

R&M DATA

MTBF	1085.	MTTR-LRU	1.4	MTTR-MOD	2.8		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	6.	PARTS/LRU	43.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2

95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	1233.	5042.	0.	6275.
SUPPORT EQUIP	0.	1530.	1530.	3059.
MANPOWER	0.	0.	316.	316.
SUPPLY	0.	451.	104.	555.
SUPPLY ADM.	0.	3.	29.	31.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	13.	13.
TOTAL COST	1233.	7025.	1992.	10250.

AVAILABILITY

INHERENT	0.9946	OPERATIONAL	0.9946

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.161	0.007

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	31.	29.	38.
BALANCE CONSUMED	1.893	0.000	38.619

COST/EFFECTIVNESS LIST (%)

2= 100.0 1= 222.3

MA300 RF MOD17 UHF TRAN

LC FILE INPUT DATA

MA300 RF MOD17 UHF TRAN

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(DO) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	6832.
LRU REPAIR TIME,HOURS(TF)	1.55
MODULE REPAIR TIME,HOURS(TMO)	3.15
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	983.
MODULE COST,$(CMP)	1474.32
PART COST,$(CPP)	28.91
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	28.91
DEVELOPMENT COST,$(CEND)	349888.
NON-RECURRING PRODUCTION COST,$(CPE)	319111.
CONTRACTOR LRU REPAIR COST,$(CUR)	49.14
CONTRACTOR MODULE REPAIR COST,$(CMR)	516.01
MODULE TYPES,(P)	2.
PART TYPES,(PP)	58.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	33377.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	38810.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.71
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.82

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.862	MODULE(EMP)	0.931	PART(EPP)	0.966

REFERENCE QUANTITIES:

UNIT(RNU)	2000.	MODULE(RNM)	2000.	PART(RNP)	2000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	4.0	MODULE(WM)	0.50	PART(WP)	0.010

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.063	MODULE(CUBEM)	0.031	PART(CUBEP)	0.0006

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.93

PRICE LIFE CYCLE COST

MA300 RF MOD17 UHF TRAN LC: MC

INPUT DATA

R&M DATA

MTBF	6832.	MTTR-LRU	1.5	MTTR-MOD	3.2		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	2.	MODS/LRU	2.	PARTS/LRU	58.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	350.	2235.	0.	2585
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	21.	21
SUPPLY	0.	266.	1271.	1537
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	5.	5
TOTAL COST	350.	2501.	1298.	4149

AVAILABILITY

INHERENT	0.9983	OPERATIONAL	0.9975

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	278.	0.	0.
BALANCE CONSUMED	982.960	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 111.3
MA300 RF MOD18 MULTI BA EX

LC FILE INPUT DATA

MA300 RF MOD1S MULTI BA EX

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	7419.
LRU REPAIR TIME,HOURS(TF)	1.38
MODULE REPAIR TIME,HOURS(TMO)	2.81
LRU PER SYSTEM,(EE)	3.
LRU COST,$(CUP)	639.
MODULE COST,$(CMP)	958.57
PART COST,$(CPP)	23.38
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	23.38
DEVELOPMENT COST,$(CEND)	293333.
NON-RECURRING PRODUCTION COST,$(CPE)	412098.
CONTRACTOR LRU REPAIR COST,$(CUR)	31.95
CONTRACTOR MODULE REPAIR COST,$(CMR)	335.50
MODULE TYPES,(P)	2.
PART TYPES,(PP)	46.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CPIM)	28165.
LRU+MODULE SUPPORT EQPT.,$(CPIP)	32750.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.60
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.69

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.858	MODULE(EMP)	0.929	PART(EPP)	0.965

REFERENCE QUANTITIES:

UNIT(RNU)	3000.	MODULE(RNM)	3000.	PART(RNP)	3000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	1.5	MODULE(WM)	0.45	PART(WP)	0.011

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.020	MODULE(CUBEM)	0.010	PART(CUBEP)	0.0002

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	3.04

PRICE LIFE CYCLE COST

MA300 RF MOD18 MULTI BA EX LC: MC:

INPUT DATA

R&M DATA

MTBF	7419.	MTTR-LRU	1.4	MTTR-MOD	2.8			

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	3.	MODS/LRU	2.	PARTS/LRU	46.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	293.	2284.	0.	2577
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	28.	28.
SUPPLY	0.	233.	1177.	1410.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	3.	3
TOTAL COST	293.	2517.	1209.	4020

AVAILABILITY

INHERENT	0.9976	OPERATIONAL	0.9938

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	374.	0.	0.
BALANCE CONSUMED	1366.352	0.000	0.000

COST/EFFECTIVENESS LIST (%)
1= 100.0 2= 107.0
MA300 F MOD19 VHF AM TRAN

LC FILE INPUT DATA

MA300 RF MOD19 VHF AM TRAN

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	6830.
LRU REPAIR TIME,HOURS(TF)	1.55
MODULE REPAIR TIME,HOURS(TMO)	3.15
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	1315.
MODULE COST,$(CMP)	1973.20
PART COST,$(CPP)	38.69
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	38.69
DEVELOPMENT COST,$(CEND)	301692.
NON-RECURRING PRODUCTION COST,$(CPE)	164928.
CONTRACTOR LRU REPAIR COST,$(CUR)	65.77
CONTRACTOR MODULE REPAIR COST,$(CMR)	690.62
MODULE TYPES,(P)	2.
PART TYPES,(PP)	58.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	33358.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	38788.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.71
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.82

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	4.0	MODULE(WM)	0.50	PART(WP)	0.010

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.063	MODULE(CUBEM)	0.031	PART(CUBEP)	0.0006

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.60

PRICE LIFE CYCLE COST

MA300 RF MOD19 VHF AM TRAN LC: MC:

INPUT DATA

R&M DATA

MTBF	6830.	MTTR-LRU	1.5	MTTR-MOD	3.2		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	2.	PARTS/LRU	58.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	302.	1447.	0.	1749.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	10.	10.
SUPPLY	0.	194.	806.	1000.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	3.	3.
TOTAL COST	302.	1641.	820.	2763.

AVAILABILITY

INHERENT	0.9991	OPERATIONAL	0.9991

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	151.	0.	0.
BALANCE CONSUMED	479.909	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 135.6
MA300 RF MOD20 VHF FM TRAN

LC FILE INPUT DATA

MA300 RF MOD20 VHF FM TRAN

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	6839.
LRU REPAIR TIME,HOURS(TF)	1.45
MODULE REPAIR TIME,HOURS(TMO)	2.95
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	1249.
MODULE COST,$(CMP)	1873.04
PART COST,$(CPP)	39.85
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	39.85
DEVELOPMENT COST,$(CEND)	278855.
NON-RECURRING PRODUCTION COST,$(CPE)	161076.
CONTRACTOR LRU REPAIR COST,$(CUR)	62.43
CONTRACTOR MODULE REPAIR COST,$(CMR)	655.56
MODULE TYPES,(P)	2.
PART TYPES,(PP)	53.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CPIM)	32523.
LRU+MODULE SUPPORT EQPT.,$(CPIP)	37817.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.69
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.80

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	3.0	MODULE(WM)	0.50	PART(WP)	0.011

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.041	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0004

DEVELOPMENT PHASE, YEARS (YD)	1.56
PRODUCTION PHASE, YEARS (YP)	2.59

PRICE LIFE CYCLE COST

MA300 RF MOD20 VHF FM TRAN LC: MC:

INPUT DATA

R&M DATA
MTBF 6839. MTTR-LRU 1.5 MTTR-MOD 2.9

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 2. PARTS/LRU 53.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	279.	1379.	0.	1658.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	10.	10.
SUPPLY	0.	184.	765.	949.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	2.	2.
TOTAL COST	279.	1563.	778.	2620.

AVAILABILITY
INHERENT 0.9991 OPERATIONAL 0.9991

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	151.	0.	0.
BALANCE CONSUMED	479.080	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 137.2
MA300 RF MOD21 HF TRAN

LC FILE INPUT DATA

MA300 RF MOD21 HF TRAN

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	6830.
LRU REPAIR TIME,HOURS(TF)	1.69
MODULE REPAIR TIME,HOURS(TMO)	3.42
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	1445.
MODULE COST,$(CMP)	2167.71
PART COST,$(CPP)	42.50
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	42.50
DEVELOPMENT COST,$(CEND)	310764.
NON-RECURRING PRODUCTION COST,$(CPE)	172552.
CONTRACTOR LRU REPAIR COST,$(CUR)	72.26
CONTRACTOR MODULE REPAIR COST,$(CMR)	756.70
MODULE TYPES,(P)	2.
PART TYPES,(PP)	56.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	34971.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	40664.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.74
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.86

OST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	6.0	MODULE(WM)	0.50	PART(WP)	0.010

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.104	MODULE(CUBEM)	0.052	PART(CUBEP)	0.0010

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.62

PRICE LIFE CYCLE COST

MA300 RF MOD21 HF TRAN LC: MC

INPUT DATA

R&M DATA

MTBF	6830.	MTTR-LRU	1.7	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	2.	PARTS/LRU	56.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	311.	1582.	0.	1893.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	10.	10.
SUPPLY	0.	213.	886.	1098.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	4.	4.
TOTAL COST	311.	1795.	901.	3006.

AVAILABILITY

INHERENT	0.9991	OPERATIONAL	0.9991

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	151.	0.	0.
BALANCE CONSUMED	479.909	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 132.8
MA300 RF MOD22 VHF AM DUALT PREAMP

LC FILE INPUT DATA

MA300 RF MOD22 VHF AM DUALT PREAMP

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	11018.
LRU REPAIR TIME,HOURS(TF)	1.44
MODULE REPAIR TIME,HOURS(TMO)	2.92
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	593.
MODULE COST,$(CMP)	868.91
PART COST,$(CPP)	14.57
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	14.57
DEVELOPMENT COST,$(CEND)	178316.
NON-RECURRING PRODUCTION COST,$(CPE)	240255.
CONTRACTOR LRU REPAIR COST,$(CUR)	29.63
CONTRACTOR MODULE REPAIR COST,$(CMR)	311.12
MODULE TYPES,(P)	2.
PART TYPES,(PP)	53.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	26062.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	30305.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.55
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.64

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP)   0.862   MODULE(EMP)   0.931   PART(EPP)   0.966

REFERENCE QUANTITIES:
UNIT(RNU)   2000.   MODULE(RNM)   2000.   PART(RNP)   2000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU)   1.3   MODULE(WM)   0.31   PART(WP)   0.005

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU)   0.020   MODULE(CUBEM)   0.010   PART(CUBEP)   0.0002

DEVELOPMENT PHASE, YEARS (YD)   1.58
PRODUCTION PHASE, YEARS (YP)   2.87

PRICE LIFE CYCLE COST

MA300 RF MOD22 VHF AM DUALT PREAMP LC: MC

INPUT DATA

R&M DATA

MTBF	11018.	MTTR-LRU	1.4	MTTR-MOD	2.9		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	2.	MODS/LRU	2.	PARTS/LRU	53.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	178.	1406.	0.	1584
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	13.	13
SUPPLY	0.	106.	515.	621
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	1.	1
TOTAL COST	178.	1512.	530.	2220

AVAILABILITY

INHERENT	0.9989	OPERATIONAL	0.9989

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	182.	0.	0.
BALANCE CONSUMED	600.450	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 140.0
MA300 RF MOD23 VHF FM DUALT PREAMP

LC FILE INPUT DATA

MA300 RF MOD23 VHF FM DUALT PREAMP

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	10562.
LRU REPAIR TIME,HOURS(TP)	1.46
MODULE REPAIR TIME,HOURS(TMO)	2.97
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	704.
MODULE COST,$(CMP)	1056.44
PART COST,$(CPP)	17.32
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	17.32
DEVELOPMENT COST,$(CEND)	123761.
NON-RECURRING PRODUCTION COST,$(CPE)	111409.
CONTRACTOR LRU REPAIR COST,$(CUR)	35.21
CONTRACTOR MODULE REPAIR COST,$(CMR)	369.75
MODULE TYPES,(P)	2.
PART TYPES,(PP)	48.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	23752.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	27619.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.50
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.56

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	1.3	MODULE(WM)	0.31	PART(WP)	0.005

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.021	MODULE(CUBEM)	0.010	PART(CUBEP)	0.0002

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.48

PRICE LIFE CYCLE COST

MA300 RF MOD23 VHF FM DUALT PREAMP   LC: MC:

INPUT DATA

R&M DATA

MTBF	10562.	MTTR-LRU	1.5	MTTR-MOD	3.0

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	2.	PARTS/LRU	48.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	124.	803.	0.	927.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	7.	7.
SUPPLY	0.	74.	292.	366.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	1.	1.
TOTAL COST	124.	877.	301.	1301.

AVAILABILITY

INHERENT	0.9994	OPERATIONAL	0.9994

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	107.	0.	0.
BALANCE CONSUMED	301.111	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 176.6
MA300 RF MOD24 HF DUALT PREAMP

LC FILE INPUT DATA

MA300 RF MOD24 HF DUALT PREAMP

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD)   2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	10663.
LRU REPAIR TIME,HOURS(TF)	1.47
MODULE REPAIR TIME,HOURS(TMD)	2.99
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	727.
MODULE COST,$(CMP)	1090.87
PART COST,$(CPP)	20.56
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	20.56
DEVELOPMENT COST,$(CEND)	157343.
NON-RECURRING PRODUCTION COST,$(CPE)	117194.
CONTRACTOR LRU REPAIR COST,$(CUR)	36.36
CONTRACTOR MODULE REPAIR COST,$(CMR)	381.81
MODULE TYPES,(P)	2.
PART TYPES,(PP)	52.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	24354.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	28319.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.52
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.60

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.878	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	1.3	MODULE(WM)	0.31	PART(WP)	0.006

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.021	MODULE(CUBEM)	0.010	PART(CUBEP)	0.0002

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.50

PRICE LIFE CYCLE COST

MA300 RF MOD24 HF DUALT PREAMP LC: MC:

INPUT DATA

R&M DATA
MTBF 10683. MTTR-LRU 1.5 MTTR-MOD 3.0

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 2. PARTS/LRU 52.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 1
LRU DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	157.	831.	0.	989.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	7.	7.
SUPPLY	0.	76.	299.	375.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	1.	1.
TOTAL COST	157.	907.	307.	1372.

AVAILABILITY
INHERENT 0.9994 OPERATIONAL 0.9994

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	106.	0.	0.
BALANCE CONSUMED	297.491	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 174.9
MA300 RF MOD26 DUAL FDM CPLR

LC FILE INPUT DATA

MA300 RF MOD26 DUAL FDM CPLR

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD;YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	9055.
LRU REPAIR TIME,HOURS(TF)	1.44
MODULE REPAIR TIME,HOURS(TMO)	2.92
LRU PER SYSTEM,(EE)	11.
LRU COST,$(CUP)	344.
MODULE COST,$(CMP)	516.16
PART COST,$(CPP)	6.37
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	6.37
DEVELOPMENT COST,$(CEND)	500895.
NON-RECURRING PRODUCTION COST,$(CPE)	1568665.
CONTRACTOR LRU REPAIR COST,$(CUR)	17.21
CONTRACTOR MODULE REPAIR COST,$(CMR)	180.65
MODULE TYPES,(P)	2.
PART TYPES,(PP)	78.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	27370.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	31826.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.58
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.67

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.838	MODULE(EMP)	0.919	PART(EPP)	0.959

REFERENCE QUANTITIES:

UNIT(RNU)	11000.	MODULE(RNM)	11000.	PART(RNP)	11000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	1.5	MODULE(WM)	0.38	PART(WP)	0.005

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.021	MODULE(CUBEM)	0.010	PART(CUBEP)	0.0001

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	3.94

PRICE LIFE CYCLE COST

MA300 RF MOD26 DUAL FDM CPLR LC: MC

INPUT DATA

R&M DATA

MTBF	9055.	MTTR-LRU	1.4	MTTR-MOD	2.9

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	11.	MODS/LRU	2.	PARTS/LRU	78.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	501.	5350.	0.	5851
SUPPORT EQUIP	0.	700.	700.	1400
MANPOWER	0.	0.	432.	432
SUPPLY	0.	55.	22.	77
SUPPLY ADM.	0.	4.	42.	46
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	3.	3
TOTAL COST	501.	6109.	1199.	7810

AVAILABILITY

INHERENT	0.9929	OPERATIONAL	0.9929

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.222	0.009

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	34.	34.	33.
BALANCE CONSUMED	9.562	0.000	22.939

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 109.4
MA300 RF MOD27 STAL PWR CONV

LC FILE INPUT DATA

MA300 RF MOD27 STAL PWR CONV

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	4400.
LRU REPAIR TIME,HOURS(TF)	1.51
MODULE REPAIR TIME,HOURS(TMO)	3.06
LRU PER SYSTEM,(EE)	6.
LRU COST,$(CUP)	915.
MODULE COST,$(CMP)	914.96
PART COST,$(CPP)	29.51
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	29.51
DEVELOPMENT COST,$(CEND)	974013.
NON-RECURRING PRODUCTION COST,$(CPE)	1120628.
CONTRACTOR LRU REPAIR COST,$(CUR)	45.75
CONTRACTOR MODULE REPAIR COST,$(CMR)	320.24
MODULE TYPES,(P)	3.
PART TYPES,(PP)	50.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	37067.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	43102.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.78
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.91

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.852 MODULE(EMP) 0.926 PART(EPP) 0.963

REFERENCE QUANTITIES:
UNIT(RNU) 6000. MODULE(RNM) 6000. PART(RNP) 6000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 6.0 MODULE(WM) 0.50 PART(WP) 0.016

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.208 MODULE(CUBEM) 0.069 PART(CUBEP) 0.0022

DEVELOPMENT PHASE, YEARS (YD)	2.08
PRODUCTION PHASE, YEARS (YP)	3.55

PRICE LIFE CYCLE COST

MA300 RF MOD27 STAL PWR CONV LC: MC

INPUT DATA

R&M DATA

MTBF	4400.	MTTR-LRU	1.5	MTTR-MOD	3.1		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	6.	MODS/LRU	3.	PARTS/LRU	50.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2

95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT; 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	974.	6604.	0.	7578
SUPPORT EQUIP	0.	948.	948.	1896
MANPOWER	0.	0.	503.	503
SUPPLY	0.	150.	100.	249
SUPPLY ADM.	0.	3.	29.	32
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	15.	15
TOTAL COST	974.	7705.	1594.	10273

AVAILABILITY

INHERENT	0.9920	OPERATIONAL	0.9920

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.261	0.011

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	35.	32.	41.
BALANCE CONSUMED	13.866	0.000	56.889

COST/EFFECTIVNESS LIST (%)

2= 100.0 1= 136.4

MA300 INT TEST

LC FILE INPUT DATA

MA300 INT TEST

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	1000.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	0.00
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	0.00
PART COST,$(CPP)	7249.54
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	50.00
DEVELOPMENT COST,$(CEND)	840526.
NON-RECURRING PRODUCTION COST,$(CPE)	621932.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	0.00
MODULE TYPES,(P)	0.
PART TYPES,(PP)	1.
FRACTION NON-STD.PARTS,(FNSP)	1.00
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	0.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.00

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.000	PART(EPP)	0.902

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.00	PART(WP)	0.030

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.000	PART(CUBEP)	0.0010

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.43

PRICE LIFE CYCLE COST

MA300 INT TEST LC: MC:

INPUT DATA

R&M DATA

MTBF	1000.	MTTR-LRU	0.0	MTTR-MOD	0.0

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	0.	PARTS/LRU	1.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 30
ON-EQUIPMENT REPAIR TO NON-REPAIRABLE PART.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	841.	6980.	0.	7821
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	59.	59
SUPPLY	0.	63.	93.	155
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	0.	0
TOTAL COST	841.	7043.	153.	8037

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	0.	1431.
BALANCE CONSUMED	0.000	0.000	2162.913

COST/EFFECTIVNESS LIST (%)
30= 100.0

LC FILE INPUT DATA

MA300 NBSP MOD101 AN

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	21150.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.24
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	276.31
PART COST,$(CPP)	0.67
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	0.67
DEVELOPMENT COST,$(CEND)	135942.
NON-RECURRING PRODUCTION COST,$(CPE)	139847.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	292.23
MODULE TYPES,(P)	1.
PART TYPES,(PP)	352.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	19484.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.41

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.931	PART(EPP)	0.966

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	2000.	PART(RNP)	2000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.000

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.71

PRICE LIFE CYCLE COST

MA300 NBSP MOD101 AN LC: MC3

INPUT DATA

R&M DATA

MTBF	21150.	MTTR-LRU	0.0	MTTR-MOD	3.2

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	2.	MODS/LRU	1.	PARTS/LRU	352.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	136.	669.	0.	805.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	6.	6.
SUPPLY	0.	293.	0.	293.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	136.	962.	7.	1105.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1106.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 195.4
MA300 NBSP MOD102 DI1

LC FILE INPUT DATA

MA300 NBSP MOD102 DI1

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	21874.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.35
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	301.77
PART COST,$(CPP)	2.03
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	2.03
DEVELOPMENT COST,$(CEND)	142087.
NON-RECURRING PRODUCTION COST,$(CPE)	148260.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	316.86
MODULE TYPES,(P)	1.
PART TYPES,(PP)	172.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CPIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CPIP)	20825.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.44

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.000 MODULE(EMP) 0.931 PART(EPP) 0.966

REFERENCE QUANTITIES:
UNIT(RNU) 0. MODULE(RNM) 2000. PART(RNP) 2000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 0.0 MODULE(WM) 0.30 PART(WP) 0.001

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.000 MODULE(CUBEM) 0.020 PART(CUBEP) 0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.77

PRICE LIFE CYCLE COST

MA300 NBSP MOD102 DI1 LC: MC3

INPUT DATA

R&M DATA

MTBF	21874.	MTTR-LRU	0.0	MTTR-MOD	3.3

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	2.	MODS/LRU	1.	PARTS/LRU	172.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	142.	723.	0.	865.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	5.	5.
SUPPLY	0.	317.	0.	317.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	142.	1040.	6.	1188.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1105.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 185.3
MA300 NBSP MOD103 DI12

LC FILE INPUT DATA

MA300 NBSP MOD103 DI12

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	21874.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.35
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	301.77
PART COST,$(CPP)	1.44
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	1.44
DEVELOPMENT COST,$(CEND)	142087.
NON-RECURRING PRODUCTION COST,$(CPE)	148260.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	316.86
MODULE TYPES,(P)	1.
PART TYPES,(PP)	218.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	20825.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.44

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.931	PART(EPP)	0.966

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	2000.	PART(RNP)	2000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.000

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.77

PRICE LIFE CYCLE COST

MA300 NBSP MOD103 DI12 LC: MC

INPUT DATA

R&M DATA

MTBF	21874.	MTTR-LRU	0.0	MTTR-MOD	3.3

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	2.	MODS/LRU	1.	PARTS/LRU	218.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	142.	723.	0.	865.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	5.	5.
SUPPLY	0.	317.	0.	317.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	142.	1040.	6.	1188.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1105.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 187.4
MA300 WBSP MOD111 DET

LC FILE INPUT DATA

MA300 WBSP MOD111 DET

DEPLOYMENT

EQUIPS(ED)	1000.	ORGANIZATION(DO)	0.	INTERMEDIATE(DI)	20.	DEPOT(DD)	2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	21849.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.32
LRU PER SYSTEM,(EE)	4.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	243.57
PART COST,$(CPP)	0.89
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	0.89
DEVELOPMENT COST,$(CEND)	169950.
NON-RECURRING PRODUCTION COST,$(CPE)	260351.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	255.75
MODULE TYPES,(P)	1.
PART TYPES,(PP)	263.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	20778.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.44

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.928	PART(EPP)	0.964

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	4000.	PART(RNP)	4000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.000

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.53
PRODUCTION PHASE, YEARS (YP)	3.14

PRICE LIFE CYCLE COST

MA300 WBSP MOD111 DET LC: MC

INPUT DATA

R&M DATA

MTBF	21849.	MTTR-LRU	0.0	MTTR-MOD	3.3

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	4.	MODS/LRU	1.	PARTS/LRU	263.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	170.	1206.	0.	1376.
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	11.	11
SUPPLY	0.	277.	0.	277
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	0.	0
TOTAL COST	170.	1483.	12.	1665

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1172.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 164.2
MA300 WBSP MOD112 EV DET

LC FILE INPUT DATA

MA300 WBSP MOD112 EV DET

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	22859.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMD)	3.42
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	450.86
PART COST,$(CPP)	3.03
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	3.03
DEVELOPMENT COST,$(CEND)	134785.
NON-RECURRING PRODUCTION COST,$(CPE)	87690.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	473.40
MODULE TYPES,(P)	1.
PART TYPES,(PP)	174.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	22783.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.48

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.001

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.53

PRICE LIFE CYCLE COST

MA300 WBSP MOD112 EV DET   LC: MC

INPUT DATA

R&M DATA

MTBF	22859.	MTTR-LRU	0.0	MTTR-MOD	3.4		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	174.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	135.	506.	0.	641.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	3.	3.
SUPPLY	0.	446.	0.	446.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0
TOTAL COST	135.	952.	4.	1091

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1068.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 200.6
MA300 WBSP MOD113 SDU MEM

LC FILE INPUT DATA

MA300 WBSP MOD113 SDU MEM

DEPLOYMENT
EQUIPS(ED)   1000. ORGANIZATION(OD)   0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	22859.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.42
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	450.86
PART COST,$(CPP)	3.03
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	3.03
DEVELOPMENT COST,$(CEND)	134785.
NON-RECURRING PRODUCTION COST,$(CPE)	87690.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	473.40
MODULE TYPES,(P)	1.
PART TYPES,(PP)	174.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	22783.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.46

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.001

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.53

PRICE LIFE CYCLE COST

MA300 WBSP MOD113 SDU MEM LC: MC:

INPUT DATA

R&M DATA

MTBF	22859.	MTTR-LRU	0.0	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	174.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	135.	506.	0.	641.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	3.	3.
SUPPLY	0.	446.	0.	446.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	135.	952.	4.	1091.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1068.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 200.6
MA300 WBSP MOD114 EV PRO

LC FILE INPUT DATA

MA300 WBSF MOD114 EV PRG

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	22859.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.42
LRU PER SYSTEM,(EE)	2.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	337.22
PART COST,$(CPP)	2.27
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	2.27
DEVELOPMENT COST,$(CEND)	150869.
NON-RECURRING PRODUCTION COST,$(CPE)	161232.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	354.08
MODULE TYPES,(P)	1.
PART TYPES,(PP)	174.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	22783.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.48

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.000 MODULE(EMP) 0.931 PART(EPP) 0.966

REFERENCE QUANTITIES:
UNIT(RNU) 0. MODULE(RNM) 2000. PART(RNP) 2000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 0.0 MODULE(WM) 0.30 PART(WP) 0.001

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.000 MODULE(CUBEM) 0.020 PART(CUBEP) 0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.85

PRICE LIFE CYCLE COST

MA300 WBSP MOD114 EV PRO   LC: MC

INPUT DATA

R&M DATA

MTBF	22859.	MTTR-LRU	0.0	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	2.	MODS/LRU	1.	PARTS/LRU	174.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	151.	803.	0.	954.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	5.	5.
SUPPLY	0.	353.	0.	353.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	151.	1156.	6.	1314.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1101.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 183.7
MA300 WBSP MOD115 EV SCH

LC FILE INPUT DATA

MA300 WBSP MOD115 EV SCH

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	22859.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.42
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	450.86
PART COST,$(CPP)	3.03
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	3.03
DEVELOPMENT COST,$(CEND)	134785.
NON-RECURRING PRODUCTION COST,$(CPE)	87690.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	473.40
MODULE TYPES,(P)	1.
PART TYPES,(PP)	174.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	22783.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.46

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.000 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 0. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 0.0 MODULE(WM) 0.30 PART(WP) 0.001

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.000 MODULE(CUBEM) 0.020 PART(CUBEP) 0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.56
PRODUCTION PHASE, YEARS (YP)	2.53

PRICE LIFE CYCLE COST

MA300 WBSF MOD115 EV SCH LC: MC:

INPUT DATA

R&M DATA

MTBF	22859.	MTTR-LRU	0.0	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	174.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	135.	506.	0.	641.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	3.	3.
SUPPLY	0.	446.	0.	446.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	135.	952.	4.	1091.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1068.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)
1= 100.0 2= 200.6
MA300 WBSF MOD116 TRAN

LC FILE INPUT DATA

MA300 WBSP MOD116 TRAN

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	21849.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.32
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	402.41
PART COST,$(CPP)	1.48
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	1.48
DEVELOPMENT COST,$(CEND)	127128.
NON-RECURRING PRODUCTION COST,$(CPE)	80701.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	422.53
MODULE TYPES,(P)	1.
PART TYPES,(PP)	263.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	20778.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.44

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.000

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.46

PRICE LIFE CYCLE COST

MA300 WBSP MOD116 TRAN LC: MC3

INPUT DATA

R&M DATA
MTBF 21849. MTTR-LRU 0.0 MTTR-MOD 3.3

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 1. MODS/LRU 1. PARTS/LRU 263.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	127.	454.	0.	581.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	3.	3.
SUPPLY	0.	399.	0.	399.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	127.	852.	4.	983.

AVAILABILITY
INHERENT 1.0000 OPERATIONAL 1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1068.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 207.6
MA300 WBSP MOD117 RS ENDE

LC FILE INPUT DATA

MA300 WBSP MOD117 RS ENDE

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	22859.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.42
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	438.63
PART COST,$(CPP)	2.95
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	2.95
DEVELOPMENT COST,$(CEND)	120318.
NON-RECURRING PRODUCTION COST;$(CPE)	87481.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST;$(CMR)	460.77
MODULE TYPES,(P)	1.
PART TYPES,(PP)	174.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	22499.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.46

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.939	PART(EPP)	0.970

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.001

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0000

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	2.53

PRICE LIFE CYCLE COST

MA300 WBSP MOD117 RS ENDE LC: M

INPUT DATA

R&M DATA

MTBF	22859.	MTTR-LRU	0.0	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	174.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	120.	494.	0.	615.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	3.	3.
SUPPLY	0.	435.	0.	435.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	120.	929.	4.	1053.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1068.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVENESS LIST (%)
1= 100.0 2= 203.0
MA300 CP MOD121 MASS MEM

LC FILE INPUT DATA

MA300 CP MOD121 MASS MEM

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	23007.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.43
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	446.89
PART COST,$(CPP)	11.97
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	11.97
DEVELOPMENT COST,$(CEND)	121335.
NON-RECURRING PRODUCTION COST,$(CPE)	88428.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	469.23
MODULE TYPES,(P)	1.
PART TYPES,(PP)	66.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	22797.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.48

COST-QUANTITY EXPONENTS (LEARNING FACTORS):
UNIT(EUP) 0.000 MODULE(EMP) 0.939 PART(EPP) 0.970

REFERENCE QUANTITIES:
UNIT(RNU) 0. MODULE(RNM) 1000. PART(RNP) 1000.

SHIPPING WEIGHT, POUNDS:
UNIT(WU) 0.0 MODULE(WM) 0.30 PART(WP) 0.003

STORAGE CUBES, CUBIC FEET:
UNIT(CUBEU) 0.000 MODULE(CUBEM) 0.020 PART(CUBEP) 0.0002

DEVELOPMENT PHASE, YEARS (YD) 1.50
PRODUCTION PHASE, YEARS (YP) 2.54

PRICE LIFE CYCLE COST

MA300 CP MOD121 MASS MEM LC: MC:

INPUT DATA

R&M DATA

MTBF	23007.	MTTR-LRU	0.0	MTTR-MOD	3.4		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	1.	PARTS/LRU	66.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	121.	503.	0.	624.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	3.	3.
SUPPLY	0.	443.	0.	443.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	121.	945.	4.	1070.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1068.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 197.3
MA300 CP MOD122 MICRO COMP

LC FILE INPUT DATA

MA300 CP MOD122 MICRO COMP

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	23414.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	3.42
LRU PER SYSTEM,(EE)	6.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	248.70
PART COST,$(CPP)	6.66
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	6.66
DEVELOPMENT COST,$(CEND)	201944.
NON-RECURRING PRODUCTION COST,$(CPE)	431618.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	261.14
MODULE TYPES,(P)	1.
PART TYPES,(PP)	66.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	23648.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.50

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.926	PART(EPP)	0.963

REFERENCE QUANTITIES:

UNIT(RNU)	0.	MODULE(RNM)	6000.	PART(RNP)	6000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.30	PART(WP)	0.003

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.020	PART(CUBEP)	0.0002

DEVELOPMENT PHASE, YEARS (YD)	1.50
PRODUCTION PHASE, YEARS (YP)	3.54

PRICE LIFE CYCLE COST

MA300 CP MOD122 MICRO COMP LC: MC

INPUT DATA

R&M DATA

MTBF	23414.	MTTR-LRU	0.0	MTTR-MOD	3.4

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	6.	MODS/LRU	1.	PARTS/LRU	66.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 1
MODULE (I.E., SMALL LRU) DISCARD AT FAILURE

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAL
EQUIPMENT	202.	1891.	0.	2093.
SUPPORT EQUIP	0.	0.	0.	0.
MANPOWER	0.	0.	15.	15.
SUPPLY	0.	298.	0.	298.
SUPPLY ADM.	0.	0.	1.	1.
CONTRACTOR SUPPORT	0.	0.	0.	0.
OTHER	0.	0.	0.	0.
TOTAL COST	202.	2189.	16.	2407.

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	1224.	0.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
1= 100.0 2= 145.5
MA300 INT TEST

LC FILE INPUT DATA

MA300 INT TEST

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2.

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	3094.
LRU REPAIR TIME,HOURS(TF)	0.00
MODULE REPAIR TIME,HOURS(TMO)	0.00
LRU PER SYSTEM,(EE)	1.
LRU COST,$(CUP)	0.
MODULE COST,$(CMP)	0.00
PART COST,$(CPP)	634.76
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	50.00
DEVELOPMENT COST,$(CEND)	115138.
NON-RECURRING PRODUCTION COST,$(CPE)	86505.
CONTRACTOR LRU REPAIR COST,$(CUR)	0.00
CONTRACTOR MODULE REPAIR COST,$(CMR)	0.00
MODULE TYPES,(P)	0.
PART TYPES,(PP)	1.
FRACTION NON-STD.PARTS,(FNSP)	1.00
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	0.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.00

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.000	MODULE(EMP)	0.000	PART(EPP)	0.891

REFERENCE QUANTITIES:

UNIT(RNU)	1000.	MODULE(RNM)	1000.	PART(RNP)	1000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	0.0	MODULE(WM)	0.00	PART(WP)	0.030

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	0.000	MODULE(CUBEM)	0.000	PART(CUBEP)	0.0010

DEVELOPMENT PHASE, YEARS (YD)	1.58
PRODUCTION PHASE, YEARS (YP)	2.28

PRICE LIFE CYCLE COST

MA300 INT TEST LC: MC:

INPUT DATA

R&M DATA

MTBF	3094.	MTTR-LRU	0.0	MTTR-MOD	0.0		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	1.	MODS/LRU	0.	PARTS/LRU	1.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 30
ON-EQUIPMENT REPAIR TO NON-REPAIRABLE PART:

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTAl
EQUIPMENT	115.	647.	0.	762
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	19.	19
SUPPLY	0.	52.	0.	52
SUPPLY ADM.	0.	0.	1.	1
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	0.	0
TOTAL COST	115.	698.	20.	834

AVAILABILITY

INHERENT	1.0000	OPERATIONAL	1.0000

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	0.	0.
UTILIZATION	0.000	0.000	0.000

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	0.	0.	1167.
BALANCE CONSUMED	0.000	0.000	0.000

COST/EFFECTIVNESS LIST (%)
30= 100.0

LC FILE INPUT DATA

MA300 ENCLOSURE 1

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	26978.
LRU REPAIR TIME,HOURS(TF)	4.46
MODULE REPAIR TIME,HOURS(TMO)	0.00
LRU PER SYSTEM,(EE)	5.
LRU COST,$(CUP)	289.
MODULE COST,$(CMP)	0.00
PART COST,$(CPP)	14.43
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	14.43
DEVELOPMENT COST,$(CEND)	133817.
NON-RECURRING PRODUCTION COST,$(CPE)	254344.
CONTRACTOR LRU REPAIR COST,$(CUR)	317.49
CONTRACTOR MODULE REPAIR COST,$(CMR)	0.00
MODULE TYPES,(P)	0.
PART TYPES,(PP)	20.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	0.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.00

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.856	MODULE(EMP)	0.000	PART(EPP)	0.964

REFERENCE QUANTITIES:

UNIT(RNU)	5000.	MODULE(RNM)	0.	PART(RNP)	5000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	7.0	MODULE(WM)	0.00	PART(WP)	0.350

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	2.052	MODULE(CUBEM)	0.000	PART(CUBEP)	0.1026

DEVELOPMENT PHASE, YEARS (YD)	1.00
PRODUCTION PHASE, YEARS (YP)	1.96

PRICE LIFE CYCLE COST

MA300 ENCLOSURE 1 LC: ML

INPUT DATA

R&M DATA
MTBF 26978. MTTR-LRU 4.5 MTTR-MOD 0.0

DEPLOYMENT
EQUIPS 1000. ORGANIZATION 0. INTERMEDIATE 20. DEPOT 2.
LRUS/EQUIP 5. MODS/LRU 0. PARTS/LRU 20.

EMPLOYMENT
SUPPORT PERIOD 10. HRS/MON 30.0 OTF 0.041

GLOBAL
EQUSUP 1000. ORGSUP 0. INTSUP 20. DEPSUP 2.
ESC 0.000 LRU FAIL ALLOW 0.

MAINTENANCE CONCEPT 2
95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	134.	1698.	0.	1832
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	74.	74
SUPPLY	0.	12.	1.	13
SUPPLY ADM.	0.	1.	11.	12
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	2.	2
TOTAL COST	134.	1711.	88.	1933

AVAILABILITY
INHERENT 0.9989 OPERATIONAL 0.9989

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.039	0.002

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	27.	0.	30.
BALANCE CONSUMED	0.000	0.000	3.298

COST/EFFECTIVNESS LIST (%)
2= 100.0 1= 114.3
MA300 ENCLOSURE 2

LC FILE INPUT DATA

MA300 ENCLOSURE 2

DEPLOYMENT
EQUIPS(ED) 1000. ORGANIZATION(OD) 0. INTERMEDIATE(DI) 20. DEPOT(DD) 2

DURATION OF SUPPORT PERIOD,YEARS(YR)	10.00
ON-TIME FRACTION(OTF)	.041
LRU MTBF,HOURS(MTBF)	29843.
LRU REPAIR TIME,HOURS(TF)	4.35
MODULE REPAIR TIME,HOURS(TMO)	0.00
LRU PER SYSTEM,(EE)	5.
LRU COST,$(CUP)	214.
MODULE COST,$(CMP)	0.00
PART COST,$(CPP)	10.72
PART COST ON-EQUIPMENT REPAIR,$(CPPE)	10.72
DEVELOPMENT COST,$(CEND)	89946.
NON-RECURRING PRODUCTION COST,$(CPE)	220616.
CONTRACTOR LRU REPAIR COST,$(CUR)	235.87
CONTRACTOR MODULE REPAIR COST,$(CMR)	0.00
MODULE TYPES,(P)	0.
PART TYPES,(PP)	20.
FRACTION NON-STD.PARTS,(FNSP)	0.50
LRU SUPPORT EQPT. COST,$(CFIM)	0.
LRU+MODULE SUPPORT EQPT.,$(CFIP)	0.
LRU S.E. FLOOR SPACE,SQ.FT.(FTSQF)	0.00
LRU+MODULE S.E. FLOOR SPACE,SQ.FT.(FTSQP)	0.00

COST-QUANTITY EXPONENTS (LEARNING FACTORS):

UNIT(EUP)	0.854	MODULE(EMP)	0.000	PART(EPP)	0.964

REFERENCE QUANTITIES:

UNIT(RNU)	5000.	MODULE(RNM)	0.	PART(RNP)	5000.

SHIPPING WEIGHT, POUNDS:

UNIT(WU)	5.0	MODULE(WM)	0.00	PART(WP)	0.250

STORAGE CUBES, CUBIC FEET:

UNIT(CUBEU)	1.000	MODULE(CUBEM)	0.000	PART(CUBEP)	0.0500

DEVELOPMENT PHASE, YEARS (YD)	1.00
PRODUCTION PHASE, YEARS (YP)	1.94

PRICE LIFE CYCLE COST

MA300 ENCLOSURE 2 LC: ML

INPUT DATA

R&M DATA

MTBF	29843.	MTTR-LRU	4.4	MTTR-MOD	0.0		

DEPLOYMENT

EQUIPS	1000.	ORGANIZATION	0.	INTERMEDIATE	20.	DEPOT	2.
LRUS/EQUIP	5.	MODS/LRU	0.	PARTS/LRU	20.		

EMPLOYMENT

SUPPORT PERIOD	10.	HRS/MON	30.0	OTF	0.041

GLOBAL

EQUSUP	1000.	ORGSUP	0.	INTSUP	20.	DEPSUP	2.
ESC	0.000	LRU FAIL ALLOW	0.				

MAINTENANCE CONCEPT 2

95% LRU REPAIR TO PIECE PART AT INT. 4% AT DEPOT. 1% SCRAP.

PROGRAM COST	DEVELOPMENT	PRODUCTION	SUPPORT	TOTA
EQUIPMENT	90.	1289.	0.	1379
SUPPORT EQUIP	0.	0.	0.	0
MANPOWER	0.	0.	65.	65
SUPPLY	0.	9.	0.	9
SUPPLY ADM.	0.	1.	11.	12
CONTRACTOR SUPPORT	0.	0.	0.	0
OTHER	0.	0.	2.	2
TOTAL COST	90.	1299.	78.	1468

AVAILABILITY

INHERENT	0.9990	OPERATIONAL	0.9990

SUPPORT EQUIPMENT	ORG	INT	DEPOT
NO.	0.	20.	2.
UTILIZATION	0.000	0.034	0.001

SUPPLY	UNITS	MODULES	PARTS
INITIAL, PER TYPE	27.	0.	29.
BALANCE CONSUMED	0.000	0.000	1.102

COST/EFFECTIVNESS LIST (%)

2= 100.0 1= 111.8